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TRANSACTIONS

OF THE

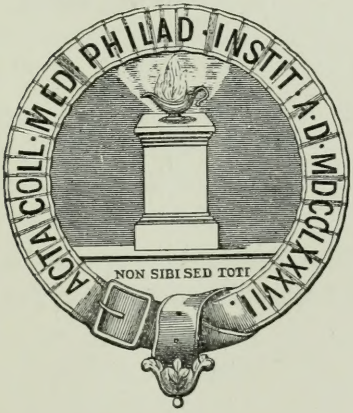
COLLEGE OF PHYSICIANS

OF

PHILADELPHIA

THIRD SERIES

VOLUME THE THIRTY-NINTH



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PHILADELPHIA
PRINTED FOR THE COLLEGE
1917

NOTICE

The present volume of TRANSACTIONS contains the papers read before the College from January, 1917, to December, 1917, inclusive.

The Committee of Publication thinks it proper to say that the College holds itself in no way responsible for the statements, reasonings, or opinions set forth in the various papers published in its TRANSACTIONS.

EDITED BY

WALTER G. ELMER, M.D.

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"This volume is published in part by the income from the Francis Houston Wyeth Fund."

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1818	THOMAS PARKE
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1835	THOMAS T. HEWSON
1848	GEORGE B. WOOD
1879	W. S. W. RUSCHENBERGER
1883	ALFRED STILLÉ
1884	SAMUEL LEWIS[2]
1884	J. M. DA COSTA
1886	S. WEIR MITCHELL
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1910	GEORGE E. DE SCHWEINITZ
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1916	RICHARD H. HARTE

[1] Died four months after his election.
[2] Resigned on account of ill-health.

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1917

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* Resigned.

FELLOWS

OF THE

COLLEGE OF PHYSICIANS OF PHILADELPHIA

DECEMBER, 1917

* Non-resident Fellows.
† Fellows who have commuted dues.

ELECTED

1892. ABBOTT, ALEXANDER C., M.D., Sc.D. (Hon.), Professor of Hygiene and Bacteriology in the University of Pennsylvania; Member of the Board of Health of Philadelphia. 4229 Baltimore Ave.

1912. ADDISON, WILLIAM H. F., A.B., M.D., Assistant Professor of Normal Histology and Embryology in the University of Pennsylvania. Medical Laboratories, University of Pennsylvania.

1905. ADLER, LEWIS H., JR., M.D., Professor of Diseases of the Rectum in the Philadelphia Polyclinic and College for Graduates in Medicine; formerly Prosector to the Professor of Anatomy in the University of Pennsylvania; Consulting Surgeon to the Charity Hospital. 1610 Arch St.

1914. AIKEN, THOMAS GERALD, M.D., Assistant Visiting Physician to the Chester County Hospital, West Chester, Pa.; Pathologist to the Country Branch of the Rush Hospital for Tuberculosis. Berwyn, Pa.

1913. ALEXANDER, EMORY G., M.D., Surgeon to St. Christopher's Hospital for Children; Associate Surgeon to the Episcopal Hospital; Clinical Professor of Surgery in the Woman's Medical College of Pennsylvania, and Demonstrator of Fracture Dressings in the Jefferson Medical College; Assistant Surgeon to the Kensington Hospital for Women. 1627 Oxford St.

ELECTED

1903. Allen, Alfred Reginald, M.D., Lecturer on Neurological Electrotherapeutics and Instructor in Neurology and Neuropathology in the University of Pennsylvania. 2013 Spruce St.

1906. Allen, Francis Olcott, Jr., A.B., M.D., Surgeon to the Presbyterian and the Children's Hospital; Assistant Surgeon to the Bryn Mawr Hospital; Surgeon to the Out-patient Department of the Pennsylvania Hospital. 2216 Walnut St.

1896. Allyn, Herman B., M.D., Associate in Medicine in the University of Pennsylvania; Physician to the Philadelphia General Hospital. 501 S. Forty-second St.

1888. Anders, James M., M.D., L.L.D., Professor of Medicine and Clinical Medicine in the Medico-Chirurgical College; Officer de l'Instruction Publique. 1605 Walnut St.

1905. Anspach, Brooke M., M.D., Associate in Gynecology in the University of Pennsylvania; Gynecologist and Obstetrician to the Philadelphia General and the Stetson Hospitals; Assistant Gynecologist to the University Hospital; Assistant Gynecologist to the Bryn Mawr Hospital. 1827 Spruce St.

1905. Appleman, Leighton F., M.D., Demonstrator of Pharmacy and Materia Medica, and Instructor in Therapeutics in the Jefferson Medical College; Associate in Ophthalmology in the Philadelphia Polyclinic and College for Graduates in Medicine; Ophthalmologist to the Frederick Douglass Memorial Hospital and to the Burd School. 308 S. Sixteenth St.

1906. Ashhurst, Astley Paston Cooper, A.B., M.D., Instructor in Surgery in the University of Pennsylvania; Surgeon to the Episcopal Hospital and to the Philadelphia Orthopædic Hospital and Infirmary for Nervous Diseases. 811 Spruce St.

1893. Ashton, Thomas G., M.D., Physician to the Philadelphia General Hospital. 1814 S. Rittenhouse Square.

1914. Austin, J. Harold, B.S. (Univ. of Penna.), M.D., Department of Research Med., University of Pennsylvania.

1906. Babbitt, James A., A.B., (Yale), A.M. (Haverford), M.D., Professor of Hygiene and Physical Education at Haverford College; Assistant Laryngologist and Aurist, and Chief of the Out-patient Department for Diseases of the Nose, Throat, and Ear at the Lankenau Hospital; Assistant Instructor in Otology in the University of Pennsylvania; Laryngologist to the Out-patient Department of the Children's Hospital. 1901 Chestnut St.

ELECTED

1910. Baer, Benjamin F., Jr., M.D. 2040 Chestnut St.

†1892. Baker, George Fales, B.S., M.D. 1818 Spruce St.

1911. Baldwin, James Harvey, A.B., M.D., Assistant Surgeon to the Methodist Hospital. 1426 Pine St.

1889. Baldy, John Montgomery, M.D., Professor of Gynecology in the Philadelphia Polyclinic; Surgeon to the Gynecean Hospital; Consulting Surgeon to the Jewish and the Frederick Douglass Memorial Hospitals. 2219 De Lancey Place.

1916. Balentine, Percival L., M.D., Assistant Surgeon, Wills Eye Hospital; Demonstrator of Ophthalmic Surgery in the Philadelphia Polyclinic. 2117 Chestnut St.

1898. Balliet, Tilghman M., A.M., M.D., Professor of Therapeutics at Dartmouth College, Hanover, N. H.; Physician to the Old Man's Home. 3709 Powelton Ave.

1911. Barnard, Everett P., M.D., Obstetrician to the Maternity Hospital; Assistant Instructor in Obstetrics in the University of Pennsylvania. 119 S. Nineteenth St.

1883. Baum, Charles, A.M., M.D., Ph.D. 1828 Wallace St.

1908. Beardsley, Edward J. G., M.D., L.R.C.P. (Lond.), Associate Professor of Clinical Medicine in the Jefferson Medical College; Chief Clinical Assistant in the Out-patient Medical Department of the Jefferson Medical College Hospital; Assistant Physician to the Jefferson and Philadelphia Hospitals. 2030 Chestnut St.

*1916. Bell, William Hemphill, M.D., Medical Inspector, U. S. N. U. S. Naval Station, Naval Operating Base, Hampton Roads, Va.

*1874. Bennett, W. H., A.M., M.D., Physician-in-Charge of the Seashore House for Invalid Children, and of the Seaside House for Invalid Women, Atlantic City; formerly Physician to the Episcopal Hospital, and Physician-in-Charge of St. Christopher's Hospital for Children. Children's Seashore Home, Atlantic City, N. J.

1896. Beyea, Henry D., M.D., Associate in Gynecology and Assistant Demonstrator of Obstetrics in the University of Pennsylvania; Assistant Surgeon to the Gynecean Hospital. 1734 Spruce St.

*1903. Biggs, Montgomery H., M.D., Surgeon to the Rutherford Hospital; Chief Surgeon of the Carolina, Churchfield and Ohio Railway. Rutherfordton, N. C.

1917. Birdsall, Joseph C., M.D. 3459 Chestnut St.

ELECTED

1908. Bland, Pascal Brooke, M.D., Chief Clinical Assistant in the Gynecological Department of the Jefferson Medical College Hospital; Instructor in Gynecology in the Jefferson Medical College; Gynecologist to St. Joseph's Hospital; Assistant Gynecologist to the Philadelphia General Hospital. 1621 Spruce St.

1917. Block, Frank B., M.D. 1503 Girard Ave.

1894. Bochroch, Max H., M.D., Neurologist to the St. Joseph's and Jewish Hospitals; Physician to the Psychopathic Wards of the Philadelphia General Hospital. 1539 Pine St.

1896. Boger, John A., A.M., M.D., Surgeon to St. Mary's Hospital; Surgeon to the Stetson Hospital; Surgeon to the Dispensary of the Episcopal Hospital. 2213 N. Broad St.

1910. Boice, J. Morton, A.B., M.D., Gynecologist to the Outpatient Department of St. Joseph's Hospital. 4020 Spruce Street.

1911. Bonney, Charles W., A.B., M.D., Demonstrator of Applied Anatomy in the Jefferson Medical College; Assistant Surgeon, Department of Oral Surgery, Philadelphia General Hospital. 1117 Spruce St.

1913. Boston, L. Napoleon, A.M., M.D., Professor of Physical Diagnosis in the Medico-Chirurgical College; Physician to the Philadelphia General Hospital; Pathologist to the Frankford Hospital. 1819 Chestnut St.

1891. Boyd, George M., M.D., Professor of Obstetrics in the Medico-Chirurgical College; Obstetrician to the Medico-Chirurgical Hospital; Physician to the Philadelphia Lying-in Charity; Obstetrician and Gynecologist to the Philadelphia General Hospital. 1909 Spruce St.

1907. Boyer, Henry Percival, M.D., Neurologist to the Stetson Hospital; Physician to the Philadelphia Home for Incurables; Assistant Physican to the Orthopædic Hospital and Infirmary for Nervous Diseases. 4602 Baltimore Ave.

1907. Bradley, William N., Ph.G., M.D., Pediatrist to Howard Hospital. 1638 S. Broad St.

1903. Branson, Thomas F., M.D., Attending Physician to the Bryn Mawr Hospital. Rosemont, Pa.

1891. Brinton, Lewis, M.D., Physician-in-Chief to the American Hospital for Diseases of the Stomach. 1301 Medical Arts Bldg., Sixteenth and Walnut Sts.

1900. Brinton, Ward, A.M., M.D., Visiting Physician to the Tuberculosis Department of the Philadelphia General Hospital; Visiting Physician to the Hospital for Poor

ELECTED

Consumptives at White Haven, Pa.; Visiting Physician to the Philadelphia Jewish Sanatorium for Consumptives. 1423 Spruce St.

1917. Bromer, Ralph S., M.D. 314 S. Fifteenth St.

1907. Brooks, Macy, A.B. (Princeton), M.D., Assistant Genito-urinary Surgeon to the Philadelphia General Hospital. 1321 Spruce St.

1916. Brown, Samuel Horton, M.D. 1901 Mt. Vernon St.

1887. Brubaker, Albert P., A.M., M.D., Professor of Physiology and Medical Jurisprudence in the Jefferson Medical College; Professor of Physiology and Hygiene in the Drexel Institute of Science, Art, and Industry. 3426 Powelton Ave.

1916. Buckley, Albert Coulson, M.D., Clinical Director, Friends' Hospital, Frankford; Alienist to the Orthopædic Hospital and Infirmary for Nervous Diseases. Friends' Hospital, Frankford, Phila.

1906. Burns, Stillwell C., M.D., Lecturer on Surgery in the Medico-Chirurgical College; Assistant Surgeon to the Medico-Chirurgical Hospital. 1326 Spring Garden St.

1892. Burr, Charles W., M.D., Professor of Mental Diseases in the University of Pennsylvania; Neurologist to the Philadelphia General Hospital. 1918 Spruce St.

1906. Butler, Ralph, M.D., Professor of Diseases of the Nose and Throat in the Philadelphia Polyclinic and the College for Graduates in Medicine; Chief of the Dispensary for Diseases of the ear at the University Hospital; Assistant Professor of Otology in the University of Pennsylvania; Laryngologist and Aurist to the Lankenau Hospital. 1926 Chestnut St.

*1908. Cadbury, William W., A.M., M.D., Canton Christian College, Canton, China.

†1907. Cadwalader, Williams B., M.D., Pathologist and Clinical Assistant to the Orthopædic Hospital and Infirmary for Nervous Diseases; Assistant Instructor in Nervous Diseases in the Philadelphia Polyclinic. 1710 Locust St.

1905. Cameron, George A., M.D., Physician to the Germantown Hospital. S. E. cor. Schoolhouse Lane and Greene St., Germantown.

1905. Carmany, Harry S., M.D., Surgeon to St. Timothy's Hospital, Roxborough; Associate Surgeon of the Episcopal Hospital; Surgeon to the Dispensary of the Episcopal Hospital. 366 Green Lane, Roxborough.

ELECTED

1910. Carnett, John Berton, M.D., Associate in Surgery in the University of Pennsylvania; Assistant Surgeon to the University and the Philadelphia General Hospitals; Surgeon to the Chestnut Hill Hospital; Consulting Surgeon to the Henry Phipps Institute, to the Phœnixville Hospital, and to the Eastern Pennsylvania Institution for the Feeble-minded and Epileptic. 123 S. Twentieth St.

1905. Carpenter, Herbert B., M.D., Physician to the Dispensary of the Children's Hospital. 1805 Spruce St.

1895. Carpenter, John T., M.D., Lecturer on Ophthalmology in the University of Pennsylvania; Assistant Ophthalmic Surgeon to the University Hospital; Attending Ophthalmologist to the Bryn Mawr Hospital. 2039 Chestnut St.

1917. Carson, John B., M.D. 348 S. Sixteenth St.

1892. Cattell, Henry W., A.M., M.D. 3709 Spruce St.

1900. Chance, Burton, M.D., Attending Surgeon to the Wills Eye Hospital; Consulting Ophthalmologist Eastern Pennsylvania Institution for the Feeble-minded and Epileptic; Ophthalmic Surgeon to the Pennsylvania Railroad Company. 235 S. Thirteenth St.

*1868. Cheston, D. Murray, M.D. Harwood P. O., Md.

1897. Cheston, Radcliffe, M.D., Visiting Physician to the Chestnut Hill Hospital; Consulting Physician to the Germantown Hospital, and to the Pennsylvania Institution for the Deaf and Dumb. Chestnut Hill.

1904. Christian, Hilary M., M.D., Clinical Professor of Genito-urinary Diseases in the Medico-Chirurgical College. 1321 Spruce St.

1903. Chrystie, Walter, M.D. One of the Senior Physicians to Bryn Mawr Hospital. Bryn Mawr, Pa.

1899. Clark, John G., M.D., Professor of Gynecology in the University of Pennsylvania; Gynecologist-in-Chief to the University Hospital. 2017 Walnut St.

1896. Cleveland, Arthur H., M.D., Clinical Professor of Laryngology in the Medico-Chirurgical College; Laryngologist to the Medico-Chirurgical Hospital; Laryngologist and Aurist to the Presbyterian Hospital, and to Pennsylvania Institution for Deaf and Dumb. 256 S. Fifteenth St.

1910. Cloud, J. Howard, M.D., Assistant Physician to the Bryn Mawr Hospital; Attending Physician to the Children's House of Bryn Mawr Hospital. 7 W. Lancaster Ave., Ardmore, Pa.

ELECTED

1903. Coates, George Morrison, A.B., M.D., Surgeon to the Out-Patient Department for Diseases of the Ear, Throat, and Nose of the Pennyslvania Hospital; Professor of Diseases of the Ear in the Philadelphia Polyclinic; Consulting Laryngologist to the Philadelphia Orphanage. 1736 Pine St.

1908. Codman, Charles A. E., M.D., Physician to the American Oncologic Hospital. 4116 Spruce St.

1907. Cohen, Myer Solis, A.B., M.D., Pediatrist to the Jewish Hospital, and to the Philadelphia Jewish Sanatorium for Consumptives, Eagleville, Pa.; Assistant Visiting Physician to the Philadelphia General Hospital; Consulting Physician to the Home for Consumptives, Chestnut Hill. 4102 Girard Ave.

1888. Cohen, Solomon Solis, M.D., Professor of Clinical Medicine in the Jefferson Medical College; Physician to the Jefferson Medical College Hospital, to the Philadelphia General Hospital, to the Jewish Hospital, and to the Rush Hospital. 1525 Walnut St.

1898. Coles, Stricker, M.D., Assistant Professor of Obstetrics in the Jefferson Medical College; Assistant Obstetrician to the Jefferson and the Philadelphia General Hospitals; Visiting Physician to the Philadelphia Lying-in-Charity Hospital. 2103 Walnut St.

1901. Coley, Thomas Luther, A.B., M.D., Attending Physician Methodist Episcopal Hospital, Philadelphia. 256 S. Fifteenth St.

1903. Coplin, W. M. L., M.D., Professor of Pathology in the Jefferson Medical College; Pathologist to and Director of the Laboratories of the Jefferson Medical College Hospital; Pathologist to the Philadelphia General Hospital and to the Friends' Asylum for the Insane, Frankford; Bacteriologist to the Pennsylvania State Board of Health. 606 S. Forty-eighth St.

1912. Copp, Owen, A.B., M.D., Physician-in-chief and Superintendent of the Pennsylvania Hospital for the Insane. Pennsylvania Hospital for the Insane, Forty-fourth and Market Sts.

1911. Cornell, Walter Stewart, A.B., M.D., Director of Medical Inspection of Public Schools of the City of Philadelphia; Chief of Medical Staff of the House of Detention; Lecturer on Osteology in the University of Pennsylvania; Lieutenant, Medical Reserve Corps, U. S. A. 729 City Hall.

ELECTED

1914. Corson, Edward Foulke, M.D., Physician for Diseases of the Skin, Presbyterian Hospital Dispensary; Assistant Dermatologist, Children's Hospital Dispensary. Cynwyd, Pa.

1907. Council, Malcolm S., M.D., Attending Physician to the Bryn Mawr Hospital; Attending Physician to the Cathcart Home at Devon. Bryn Mawr, Pa.

*1909. Craig, Alexander R., A.M., M.D. 535 N. Dearborn St., Chicago, Ill.

1904. Craig, Frank A., M.D., Instructor in Medicine in the University of Pennsylvania; Visiting Physician to the Henry Phipps Institute, University of Pennsylvania; Visiting Physician to the White Haven Sanatorium; Physician-in-Charge of the Tuberculosis Class of the Presbyterian Hospital. 244 S. Twenty-first St.

1907. Crampton, George S., M.D., Attending Surgeon to the Eye Department of the Pennsylvania Hospital and the Philadelphia Hospital for Contagious Diseases; Assistant Surgeon to the Wills Hospital; Lecturer on Physiologic Optics in the Philadelphia Polyclinic and School for Graduates in Medicine; Ophthalmologist to the Philadelphia Orphanage. 1700 Walnut St.

1917. Cross, Sumner H., A.B., M.D., Physician to the Abington Memorial Hospital, Abington, Pa. 412 York Road, Jenkintown, Pa.

1904. Cruice, John M., M.D., Physician to the Henry Phipps Institute of the University of Pennsylvania; Physician to the Medical Dispensary of St. Agnes' Hospital; Instructor in Medicine in the University of Pennsylvania. 1932 Spruce St.

*1910. Cummins, W. Taylor, M.D., Pathologist to the Southern Pacific Hospital; Director of the Mary W. Harriman Research Laboratory, San Francisco, Cal.

1902. Currie, Charles A., M.D., Physician to the Germantown Hospital. West Walnut Lane, Germantown.

1903. Da Costa, John C., Jr., M.D., Associate Professor of Medicine in the Jefferson Medical College; Assistant Physician to the Jefferson Medical College Hospital; Hematologist to the German Hospital; Consulting Physician to the Northwestern General Hospital. 1529 Pine St.

1896. Da Costa, John Chalmers, M.D., Professor of the Principles of Surgery and of Clinical Surgery in the Jefferson Medical College; Surgeon to the Philadelphia General and St. Joseph's Hospitals. 2045 Walnut St.

ELECTED

1887. Daland, Judson, M.D., Professor of Clinical Medicine in the Graduate School of Medicine, University of Pennsylvania. 317 S. Eighteenth St.

°1859. Darrach, James, M.D., Consulting Surgeon to the Germantown Hospital. 5923 Greene St., Germantown.

1896. Davis, Charles N., M.D., Dermatologist to the Pennsylvania Hospital; Consulting Dermatologist to St. Agnes' Hospital; Assistant Physician to the Dispensary for Skin Diseases in the Howard Hospital. 1931 Spruce St.

1888. Davis, Edward P., A.M., M.D., Professor of Obstetrics in the Jefferson Medical College; Obstetrician to the Jefferson Hospital; Obstetrician and Gynecologist to the Philadelphia General Hospital; Consultant to the Preston Retreat. 250 S. Twenty-first St.

1889. Davis, Gwilym G., M.D. (Univ. of Penna. and Göttingen), LL.D., M.R.C.S. (Eng.), Professor of Orthopedic Surgery in the University of Pennsylvania; Surgeon to the Orthopædic Hospital and Infirmary for Nervous Diseases; Orthopedic Surgeon to the Philadelphia General Hospital; Consulting Surgeon to St. Joseph's Hospital. 1814 Spruce St.

1916. Davis, Warren B., M.D., Oral Surgeon, Philadelphia General Hospital; Assistant Rhinologist and Otologist St. Agnes' Hospital; Assistant Demonstrator of Anatomy Jefferson Medical College; Clinical Assistant in Surgical Dispensary Jefferson Hospital. 135 S. Eighteenth St.

1900. Davisson, Alex. Heron, M.D., Physician-in-Charge, State Tuberculosis Dispensary at Ardmore, Pa. 1017 S. Forty-sixth St.

1894. Deaver, Harry C., M.D., Professor of Surgery in the Woman's Medical College of Pennsylvania; Surgeon to the Episcopal Hospital, and to the Children's Hospital of the Mary J. Drexel Home; Surgeon-in-Chief to the Kensington Hospital for Women. 1415 N. Broad St.

1887. Deaver, John B., M.D., D.Sc., LL.D., Professor of the Practice of Surgery in the University of Pennsylvania; Surgeon-in-Chief to the Lankenau Hospital. 1634 Walnut St.

1902. Dehoney, Howard, M.D. 240 S. Thirteenth St.

1885. Dercum, Francis X., A.M., M.D., Ph.D., Professor of Nervous and Mental Diseases in the Jefferson Medical College; Consulting Neurologist to the Philadelphia General Hospital; Foreign Corresponding Member of the Neurological Society of Paris, and Corresponding Member of the Psychiatric and Neurological Society of Vienna. 1719 Walnut St.

ELECTED

1908. Despard, Duncan L., M.D., Surgeon to the Abington Memorial Hospital; Assistant Surgeon to the Jefferson Medical College Hospital; Demonstrator of Clinical Surgery in the Jefferson Medical College; Associate in Gynæcology in the Philadelphia Polyclinic Hospital. 1806 Pine St.

1912. Dewey, J. Hiland, Ph.B., M.D., Assistant Surgeon to Wills Eye Hospital; Ophthalmic Surgeon to St. Francis' Hospital, Trenton, N. J. 1436 Diamond St.

*1911. Dickson, Frank D., M.D. St. Regis Hotel, Kansas City, Mo.

1908. Dillard, Henry K., Jr., M.D., Physician to the Out-patient Department of the Pennsylvania Hospital; Physician to the Dispensary of the Mary J. Drexel Home. 234 S. Twentieth St.

1891. Dixon, Samuel G., M.D., LL.D., Commissioner of Health of Pennsylvania; President of the Academy of Natural Sciences of Philadelphia; Member of the Philadelphia Bar. Bryn Mawr, Pa.

*1897. Dorland, W. A. Newman, A.M., M.D., Professor of Gynecology in the Post-graduate Medical School of Chicago; Professor of Obstetrics in the Chicago College of Medicine and Surgery; Visiting Obstetrician to Cook County Hospital; First Lieutenant, Medical Reserve Corps, U. S. Army. 7 West Madison St., Chicago, Ill.

1907. Dorrance, George Morris, M.D., Surgeon to St. Agnes' Hospital; Demonstrator of Applied Anatomy in the Dental Department of the University of Pennsylvania. 2025 Walnut St.

°1864. Downs, R. N., M.D., Consulting Physician to the Germantown Hospital. 5916 Greene St., Germantown.

1902. Downs, Robert N., Jr., M.D., Surgeon to the Dispensary of the Germantown Hospital. 6008 Greene St., Germantown.

1910. Drayton, William, Jr., M.D., Physician to the Philadelphia Hospital for Contagious Diseases; Physician to the Out-patient Department of the Pennsylvania Hospital; Physician to the Pennsylvania Institute for the Instruction of the Blind; Assistant Physician to the Philadelphia Orthopædic Hospital and Infirmary for Nervous Diseases. 1316 Locust Street.

1881. Dulles, Charles Winslow, M.D., Consulting Surgeon of the Rush Hospital. 4101 Walnut St.

ELECTED

1911. Earnshaw, Henry Culp, M.S., M.D., Attending Physician to the Hospital of the Good Shepherd, Rosemont; Assistant Attending Physician to the Bryn Mawr Hospital; Attending Physician to the Bryn Mawr Children's Hospital; Pennsylvania Railroad Surgeon. Bryn Mawr, Pa.

*1887. Edwards, William A., M.D., Professor of Pediatrics in the Medical Department of the University of California. Fifth and Spring Sts., Los Angeles, Cal.

1911. Eliason, Eldridge E., B.A., M.D., Assistant Instructor in Surgery in the University of Pennsylvania; Assistant Surgeon to the University Hospital; Assistant Surgeon to the Howard Hospital; Surgeon to the Out-patient Department of the Children's Hospital. 320 S. Sixteenth Street.

1904. Elmer, Walter G., B.S., M.D., Instructor in Orthopedic Surgery in the University of Pennsylvania; Assistant Orthopedic Surgeon to the University Hospital; Orthopedic Surgeon to the Jewish Hospital; Surgeon to the Pennsylvania Training School for Children. 1801 Pine St.

1896. Ely, Thomas C., A.M., M.D. 2041 Green St.

1901. Erck, Theodore A., M.D., Surgeon to the Gynecean Hospital; Obstetrician to the Jewish Maternity Hospital; Associate in Gynecology in the Philadelphia Polyclinic and College for Graduates in Medicine. 251 S. Thirteenth St.

1893. Eshner, Augustus A., M.D., Professor of Clinical Medicine in the Philadelphia Polyclinic and College for Graduates in Medicine; Physician to the Philadelphia General Hospital; Assistant Physician to the Orthopædic Hospital and Infirmary for Nervous Diseases; Consulting Physician to Mercy Hospital. 1019 Spruce St.

*1905. Evans, Joseph S., Jr., A.B., M.D., Professor of Clinical Medicine in the University of Wisconsin; Consulting Physician, Madison General Hospital. University of Wisconsin, Madison, Wis.

1905. Evans, William, M.D. 4007 Chestnut St.

1912. Eves, Curtis C., M.D., Aural and Laryngeal Surgeon to the Episcopal Hospital; Assistant in the Out-patient Department for Diseases of the Ear, Throat, and Nose of the Pennsylvania Hospital; Demonstrator of Operative Surgery of the Ear, Nose, and Throat in the Philadelphia Polyclinic. 1700 Walnut St.

ELECTED

1894. Faries, Randolph, M.D. 2007 Walnut St.

†1903. Farr, Clifford B., A.B., M.D., Professor of Diseases of the Stomach, etc., in the Philadelphia Polyclinic; Associate in Medicine in the University of Pennsylvania; Assistant Physician to the Philadelphia General Hospital. 117 S. Twenty-second Street.

1893. Farr, William W., M.D., Physician to the Leamy Home. Springfield Ave. and Lincoln Drive, Chestnut Hill.

1884. Fenton, Thomas H., M.D., Ophthalmologist to St. Vincent's Home, to the Home for Aged Couples, to the Baptist Home, and to the House of the Good Shepherd. 1319 Spruce St.

1907. Ferguson, Albert D., M.D., Physician-in-charge of the Widener Memorial School for Crippled Children. 50 E. Johnson St., Germantown.

1907. Fetterolf, George, A.B., M.D., Sc.D., Laryngologist to the Henry Phipps Institute for Tuberculosis; Laryngologist to the White Haven Sanatorium; Consulting Laryngologist to the Phœnixville Hospital; Demonstrator of Anatomy in the University of Pennsylvania. 134 S. Twentieth St.

1907. Fife, Charles A., A.B., M.D., Instructor in Pediatrics in the University of Pennsylvania; Pediatrist to the Presbyterian Hospital; Physician to the St. Christopher's Hospital for Children; Assistant Physician to the Philadelphia General Hospital. 2038 Chestnut St.

1884. Fisher, Henry M., M.D. 1027 Pine St.

1910. Fisher, John Monroe, M.D., Associate Professor of Gynecology in the Jefferson Medical College; Gynecologist to the Philadelphia, St. Agnes', and Pottstown Hospitals; Assistant Gynecologist to the Jefferson Medical College Hospital. 222 S. Fifteenth St.

1888. Flick, Lawrence F., M.D. 736 Pine St.

1916. Forst, John R., M.D. 166 W. Coulter St., Germantown.

1908. Foulkrod, Collin, M.D., Obstetrician to the Maternity House of the Presbyterian Hospital; Assistant Demonstrator of Obstetrics in Jefferson Medical College; Gynecologist to the Dispensary of the Presbyterian Hospital. 4005 Chestnut St.

1908. Fox, Herbert, M.D., Director of the William Pepper Laboratory of Clinical Medicine, University of Pennsylvania; Pathologist to the Laboratory of Comparative Pathology

ELECTED

of the Zoölogical Society of Philadelphia; Pathologist to the Rush Hospital; Pathologist to the Children's Hospital. 3902 Locust St.

†1885. Fox, Joseph M., M.D. Torresdale, Pa.

1906. Fraley, Frederick, Jr., A.B., M.D. 1701 De Lancey Place.

1903. Francine, Albert Philip, A.M., M.D., Associate in Medicine in the University of Pennsylvania; Visiting Physician to the Philadelphia General Hospital, Department of Tuberculosis; Physician-in-Chief to the State Dispensary for Tuberculosis, Philadelphia. 264 S. Twenty-first St.

1897. Frazier, Charles H., A.B., M.D., Sc.D., Professor of Clinical Surgery in the University of Pennsylvania; Surgeon to the University Hospital. 1724 Spruce St.

†1890. Freeman, Walter J., M.D., Emeritus Professor of Laryngology in the Philadelphia Polyclinic; Consulting Laryngologist to the Pennsylvania Institution for the Deaf and Dumb. 1832 Spruce St.

1916. Funk, Elmer Hendricks, M.D. 1318 Spruce St.

1910. Furbush, Charles Lincoln, M.D. 1501 Spruce St.

1889. Fussell, M. Howard, M.D., Professor of Applied Therapeutics in the University of Pennsylvania; Physician to the University Hospital, the Episcopal Hospital, St. Timothy's Hospital, and St. Mary's Hospital. 2035 Walnut St.; 421 Lyceum Ave., Roxborough.

1899. Gamble, Robert G., M.D., one of the Attending Physicians to the Bryn Mawr Hospital. Haverford, Pa.

1912. Gaskill, Henry Kennedy, M.D., Assistant Professor of Dermatology in the Jefferson Medical College; Attending Dermatologist to the Philadelphia General Hospital. 1610 Spruce St.

1917. Gerhard, Arthur Howell, M.D. 2110 Pine St.

1873. Gerhard, George S., M.D., Physician-in-Chief to the Bryn Mawr Hospital; Consulting Physician to Bryn Mawr College; Consulting Physician to Villa Nova College. Fifty-eighth Street and Overbrook Ave.

1902. Ghriskey, Albert A., M.D. 3936 Walnut St.

1899. Gibbon, John H., M.D., Professor of Surgery in the Jefferson Medical College; Surgeon to the Pennsylvania and the Bryn Mawr Hospitals. 1608 Spruce St.

ELECTED

1908. Gildersleeve, Nathaniel, M.D., Professor of Microbiology and Bacteriopathology; The Thomas W. Evans Museum and Dental Institute School of Dentistry University of Pennsylvania. School of Dentistry, University of Pennsylvania.

1913. Ginsburg, Nathaniel, M.D., Surgeon to the Jewish Hospital; Associate in Surgery in the Philadelphia Polyclinic and College for graduates in Medicine; Assistant Surgeon to Mt. Sinai Hospital; Instructor in Anatomy in the University of Pennsylvania. 1704 Pine St.

1897. Girvin, John H., M.D., Physician for Diseases of Women at the Presbyterian Hospital; Instructor in Obstetrics in the University of Pennsylvania. 2120 Walnut St.

1906. Gittings, J. Claxton, M.D., Instructor in Pediatrics in the University of Pennsylvania; Assistant Pediatric Physician to the University Hospital; Visiting Physician to the Children's Hospital; Consulting Physician to the Sheltering Arms and the Presbyterian Orphanage. 3903 Chestnut St.

1905. Given, Ellis E. W., M.D., Surgeon to the Philadelphia Freemasons Memorial Hospital of the Masonic Home, Elizabethtown, Pa.; Surgeon to the Dispensary of the Episcopal Hospital. 2018 Chestnut St.

1894. Gleason, E. B., S.B., M.D., LL.D., Professor of Otology in the Medico-Chirurgical College. 2033 Chestnut St.

1906. Goepp, R. Max, M.D., Professor of Clinical Medicine, Dean of the College Department, and Secretary of the Faculty of the Philadelphia Polyclinic and College for Graduates in Medicine; Assistant Professor of Clinical Medicine in the Jefferson Medical College; Assistant Visiting Physician to the Philadelphia General Hospital. 124 S. Eighteenth St.

1906. Goldberg, Harold G., M.D., Ophthalmic Surgeon to the Episcopal Hospital and to the Kensington Hospital for Women. 1925 Chestnut St.

1893. Goodell, W. Constantine, M.D. 300 S. Thirteenth St.

1908. Goodman, Edward H., M.D., Associate in Medicine in the University of Pennsylvania; Consultant to the Medical Dispensary of the University Hospital; Assistant Physician to the University Hospital; Assistant Physician to the Philadelphia General Hospital. 248 S. Twenty-first St.

1905. Gordon, Alfred, M.D., Neurologist to the Mt. Sinai, the Northwestern General, and the Douglass Memorial Hospitals. 1812 Spruce St.

ELECTED

*†1897. Gould, George M., A.M., M.D. 215 Atlantic Ave., Atlantic City, N. J.

1894. Graham, Edwin E., M.D., Professor of Pediatrics in the Jefferson Medical College; Pediatrist to the Jefferson and the Philadelphia General Hospitals; Physician to the Franklin Reformatory Home. 1713 Spruce St.

1885. Graham, John, M.D. 326 S. Fifteenth St.

1904. Grayson, Charles P., M.D., Professor of Laryngology and Rhinology in the University of Pennsylvania; Physician-in-Charge of the Throat and Nose Department of the University Hospital; Otolaryngologist to the Philadelphia General Hospital. 262 S. Fifteenth St.

1910. Greenman, Milton J., M.D., Sc.D., Director of the Wistar Institute of Anatomy and Biology. Wistar Institute of Anatomy and Biology, Thirty-sixth St. and Woodland Ave.

1883. Griffith, J. P. Crozer, M.D., Professor of Pediatrics in the University of Pennsylvania; Corresponding Member of the Société de Pédiatrie de Paris. 1810 Spruce St.

1912. Griscom, J. Milton, B.S., M.D., Assistant Surgeon to the Wills Eye Hospital; Chief of Clinic of the Eye Dispensary of the Presbyterian Hospital. 1925 Chestnut St.

1911. Gummey, Frank Bird, M.D., Visiting Physician to the Germantown Hospital and Dispensary; Visiting Physician to the Midnight Mission. 5418 Greene St., Germantown.

*1902. Gwyn, Norman B., M.D., Instructor in Medicine in the University of Pennsylvania. 20 S. Twenty-first St.

1894. Hamill, Samuel McC., M.D., Professor of Diseases of Children in the Philadelphia Polyclinic and College for Graduates in Medicine; Pediatrist to the Presbyterian Hospital; Pediatrist to St. Vincent's Home. 1822 Spruce St.

1897. Hand, Alfred, Jr., M.D., Visiting Physician to the Children's Hospital, to the Children's Hospital of the Mary J. Drexel Home, and to the Methodist Hospital. 1724 Pine St.

1886. Hansell, Howard F., M.D., Professor of Ophthalmology in the Jefferson Medical College; Ophthalmic Surgeon to the Philadelphia General Hospital and to the Jefferson Medical College Hospital; Emeritus Professor of Diseases of the Eye in the Philadelphia Polyclinic. N. E. Cor. 17th and Walnut Sts.

ELECTED

1889. Hare, Hobart A., M.D., Professor of Therapeutics, Materia Medica, and Diagnosis in the Jefferson Medical College, 1801 Spruce St.

1903. Hart, Charles D., A.M., M.D., Inspector and Secretary of the Eastern State Penitentiary; National Executive Committee and Chairman of the Philadelphia Committee, Boy Scouts of America. 1317 Walnut St.

1885. Harte, Richard H., M.D., Adjunct Professor of Surgery in the University of Pennsylvania; Surgeon to the Pennsylvania and the Orthopædic Hospitals; Consulting Surgeon to St. Mary's, St. Timothy's, and the Bryn Mawr Hospitals. 1503 Spruce St.

1888. Hartzell, Milton B., A.M., M.D., LL.D., Professor of Dermatology in the University of Pennsylvania. 3644 Chestnut St.

1907. Hatfield, Charles James, A.B. (Princeton), M.D., Executive Director of the Henry Phipps Institute for the Study, Treatment, and Prevention of Tuberculosis; Visiting Physician to the White Haven Sanatorium. 2008 Walnut Street.

1872. Hays, I. Minis, M.D. 266 S. Twenty-first St.

1911. Heed, Charles R., M.D., Associate Professor of Ophthalmology in the Philadelphia Polyclinic; Instructor in Ophthalmology in the Jefferson Medical College; Ophthalmologist to Girard College. 1402 Spruce St.

1908. Heineberg, Alfred, P.D., M.D., Associate in Gynecology in the Jefferson Medical College; Assistant Gynecologist to St. Agnes' Hospital. 1642 Pine St.

1901. Heisler, John C., M.D., Professor of Anatomy in the Medico-Chirurgical College. 3829 Walnut St.

1884. Henry, Frederick P., A.M., M.D., Emeritus Professor of the Principles and Practice of Medicine in the Woman's Medical College of Pennsylvania; Emeritus Physician to the Philadelphia General Hospital; Consulting Physician to the Chestnut Hill Hospital. 114 S. Eighteenth St.

1903. Henry, J. Norman, M.D., Physician to the Pennsylvania Hospital; Clinical Professor of Medicine in the Woman's Medical College of Pennsylvania; Assistant Physician to the Philadelphia General Hospital. 1906 Spruce St.

1891. Hewson, Addinell, A.B., A.M., M.D., Professor of Anatomy in the Philadelphia Polyclinic and College for Graduates in

ELECTED

Medicine; Professor of Anatomy and Histology in the Temple University; Surgeon to St. Timothy's Hospital, Roxborough. 2120 Spruce St.

1909. Higbee, William S., M.D., President of the Pennsylvania State Board of Examiners for Registration of Nurses. 1703 S. Broad St.

1910. Hill, Howard Kennedy, M.D., Assistant Instructor in Medicine in the University of Pennsylvania; Physician to the Children's Medical Dispensary of the Presbyterian Hospital; Visiting Physician to the University Settlement, and to the Day Nursery; Assistant Physician to the Medical Dispensary of the Children's Hospital. 314 S. Seventeenth Street.

1897. Hinkle, William M., M.D., Lecturer on the Anatomy and Physiology of the Vocal Organs in the National School of Elocution and Oratory. 1323 N. Thirteenth St.

*1892. Hinsdale, Guy, A.M., M.D., Associate Professor of Climatology in the University of Pennsylvania. Hot Springs, Virginia.

1888. Hirsh, A. Bern, M.D., Physician to the Home for Aged Couples. 22 S. Twenty-first St.

1888. Hirst, Barton Cooke, A.B., M.D., LL.D., Professor of Obstetrics in the University of Pennsylvania; Gynecologist to the Philadelphia General and the Howard Hospitals. 1821 Spruce Street.

1903. Hirst, John Cooke, M.D., Associate in Obstetrics, University of Pennsylvania; Gynecologist and Obstetrician to the Philadelphia General Hospital; Obstetrician to St. Agnes' Hospital; Gynecologist to the American Hospital for Diseases of the Stomach; Assistant Obstetrician to the University Hospital. 1823 Pine St.

1908. Hitchens, Arthur Parker, M.D. Glenolden, Pa.

1905. Hodge, Edward Blanchard, A.B., M.D., Surgeon to the Presbyterian and the Children's Hospitals; Surgeon to the Out-patient Department of the Pennsylvania Hospital; Associate Surgeon to the Widener Memorial School. 346 S. Sixteenth Street.

1913. Hoffman, Clarence, M.D., 425 S. Carlisle St.

°1885. Holland, James W., A.M., M.D., Sc.D., Emeritus Professor of Medical Chemistry and Toxicology and Dean of the Jefferson Medical College. 2006 Chestnut St.

ELECTED

1906. Holloway, Thomas B., M.D., Professor of Ophthalmology in the Philadelphia Polyclinic and School for Graduates in Medicine; Instructor in Ophthalmology in the University of Pennsylvania; Ophthalmologist to the Orthopædic Hospital and Infirmary for Nervous Diseases; Ophthalmologist to the Pennsylvania Institution for the Instruction of the Blind at Overbrook. 1819 Chestnut St.

1914. Hooker, Richard S., M.D. 110 S. Nineteenth St.

1908. Hoyt, Daniel M., M.D., Assistant Visiting Physician to the Philadelphia General Hospital. 3604 Chestnut St.

*1912. Huber, G. Carl, M.D., Professor of Anatomy and Director of the Anatomic Laboratories in the University of Michigan. 1330 Hill St., Ann Arbor, Mich.

1892. Hughes, William E., M.D., Visiting Physician to the Philadelphia General Hospital; Pathologist to the Presbyterian Hospital. 3945 Chestnut St.

1912. Hunter, John W., B.S., M.D. 2042 Pine St.

1898. Hutchinson, James P., M.D., Surgeon to the Pennsylvania, the Methodist, the Children's, St. Timothy's, and the Bryn Mawr Hospitals; Adjunct Professor of Surgery in the University of Pennsylvania. 133 S. Twenty-second St.

1871. Ingham, James V., M.D. 1811 Walnut St.

1917. Jackson, Chevalier, M.D. Seventeenth and Walnut Sts.

*1885. Jackson, Edward, A.M., M.D., Sc.D., Professor of Ophthalmology in the University of Colorado; Emeritus Professor of Diseases of the Eye in the Philadelphia Polyclinic. 318 Majestic Building, Denver, Col.

*1906. Jacobs, Francis Brinton, B.S., M.D., Assistant Surgeon to the Chester County Hospital. Whitford, Pa.

1913. Jefferys, William Hamilton, A.B., A.M., M.D., Surgeon to St. Luke's Hospital, Shanghai; Professor of Surgery in St. John's University, Shanghai; Editor of the China Medical Journal. New Street, Chestnut Hill.

1898. Johnson, Russell H., A.B. (Princeton), M.D., Physician to the Pennsylvania Institution for the Deaf and Dumb. Chestnut Hill, Philadelphia.

1900. Jones, Charles James, A.M., M.D., LL.D., Ophthalmic Surgeon to St. Joseph's Hospital; Ophthalmic Surgeon to the House of the Good Shepherd, Germantown; Consulting Ophthalmologist to St. Vincent's Home. 1507 Locust Street.

ELECTED

1914. Jones, Isaac H., A.B., A.M., M.D. Medical Arts Building, Sixteenth and Walnut Sts.

1913. Jones, John F. X., B.S., A.B., A.M., M.D., Surgeon to St. Joseph's Hospital. 1815 Spruce St.

1900. Jopson, John H., M.D., Professor of Surgery in the Philadelphia Polyclinic; Associate in Surgery in the University of Pennsylvania; Surgeon to the Presbyterian and the Children's Hospitals. 1824 Pine St.

1900. Judson, Charles F., A.B., M.D., Physician to St. Christopher's Hospital for Children, to the Southern Home for Destitute Children and to the Sheltering Arms. 1005 Spruce St.

1902. Jump, Henry D., M.D., Instructor in Medicine in the University of Pennsylvania; Assistant Physician to the Medical Dispensary of the University Hospital. 4634 Chester Ave.

1886. Jurist, Louis, M.D. 1308 N. Broad St.

1903. Kalteyer, Frederick J., M.D., Demonstrator of Clinical Medicine in the Jefferson Medical College; Chief of the Out-patient Department, Assistant Attending Physician, and Hematologist to the Jefferson Medical College Hospital; Pathologist to Philadelphia Lying-in Charity. 1533 Pine St.

*1910. Karsner, Howard T., M.D., Professor of Pathology in the Western Reserve University Medical School. Lakeside Hospital, Cleveland, Ohio.

†1867. Keen, William W., M.D., LL.D., (Hon.) F.R.C.S. (Eng. and Edin.), Emeritus Professor of the Principles of Surgery and of Clinical Surgery in the Jefferson Medical College; Membre Correspondant Etranger de la Société de Chirurgie de Paris; Honorary Member of the Société Belge de Chirurgie and of the Clinical Society of London. 1729 Chestnut St.

1912. Keene, Floyd E., M.D., Instructor in Gynecology in the University of Pennsylvania; Assistant Gynecologist to the University Hospital; Gynecologist to the Chestnut Hill Hospital. 5017 Walnut St.

1913. Kelly, Francis Joseph, M.D. 1809 Chestnut St.

*1887. Kelly, Howard A., A.B., M.D., LL.D. (Aberdeen, Wash. and Lee, and Univ. of Pa.), Professor of Gynecology in Johns Hopkins University and Gynecologist to the Johns Hopkins Hospital, Baltimore, Md.; Hon. Fellow of the Edinburgh Obstetrical Society, the Royal Academy of Medicine of Ireland, and of the Glasgow Obstetrical and Gynecological Society. 1418 Eutaw Place, Baltimore, Md

ELECTED

1909. Kelly, James A., A.M., M.D., Visiting Surgeon to St. Mary's and St. Timothy's Hospitals; Associate in Surgery in the Philadelphia Polyclinic and College for Graduates in Medicine; Assistant Visiting Surgeon to St. Joseph's Hospital. 1510 N. Seventeenth St.

1912. Kelly, Thomas C., A.M., M.D., Assistant Instructor of Medicine in the University of Pennsylvania; Pediatrician to St. Mary's Hospital; Physician to Out-patient Department of Germantown Hospital. 105 School Lane, Germantown.

1898. Kempton, Augustus F., M.D. 2118 Pine St.

1905. Kercher, Delno E., M.D. 1534 Pine St.

1913. Klopp, Edward J., M.D., Instructor in Surgery in the Jefferson Medical College; Assistant Surgeon to the Germantown Hospital; Chief Clinical Assistant in the Surgical Department of the Jefferson Hospital; Assistant Surgeon to the Out-patient Department of the Pennsylvania Hospital. 1223 Spruce St.

1895. Kneass, Samuel S., M.D., Associate in the William Pepper Laboratory of Clinical Medicine in the University of Pennsylvania. 1510 Walnut St.

1908. Knipe, Jay C., M.D., Ophthalmologist to the Jewish Hospital; Assistant Ophthalmologist to the Philadelphia General Hospital, and to the Mary J. Drexel Home; Chief of the Eye Clinic at the Jefferson Medical College Hospital; Demonstrator of Osteology and Syndesmology in the Jefferson Medical College. 2035 Chestnut St.

1908. Knowles, Frank Crozer, M.D., Instructor in Dermatology in the University of Pennsylvania; Clinical Professor of Dermatology in the Woman's Medical College; Dermatologist to the Presbyterian Hospital; Assistant Dermatologist to the Dispensary of the Pennsylvania Hospital. 2022 Spruce Street.

1914. Kolmer, John A., M.D., Dr. P.H., M.Sc., Assistant Professor of Experimental Pathology in the University of Pennsylvania; Professor of Pathology and Pathologist to the Department of Dermatological Research, Philadelphia Polyclinic; Pathologist to the Philadelphia Hospital for Contagious Diseases; Serologist to St. Agnes' and St. Timothy's Hospitals. 927 S. St. Bernard St.

1904. Krauss, Frederick, M.D., Ophthalmic Surgeon to the Episcopal Hospital; Ophthalmic and Aural Surgeon to St. Christopher's Hospital for Children; Laryngologist to the

ELECTED

Abington Hospital; Ear, Nose and Throat Physician to the Children's Seashore House for Invalid Children, Atlantic City, N. J. 1701 Chestnut Street.

1905. Kremer, Walter H., M.D., 5904 Greene St., Germantown.

1914. Krumbhaar, Edward B., A.B., Ph.D., M.D., Assistant Professor in Research Medicine University of Pennsylvania; Physician to Out-patient Department, Pennsylvania Hospital. W. Mermaid Lane, Chestnut Hill.

1900. Krusen, Wilmer, M.D., Professor of Gynecology in the Medical Department of Temple University; Chief Gynecologist to the Samaritan and the Garretson Hospitals; Consulting Gynecologist to the Charity and Mercy Hospitals. 127 N. Twentieth St.

1909. Laird, J. Packard, M.D., Visiting Physician to the Devon Branch of Presbyterian Hospital of Philadelphia. Devon, Pa.

1904. Landis, Henry R. M., M.D., Director of the Clinical and Sociological Departments of the Henry Phipps Institute of the University of Pennsylvania; Assistant Professor in Medicine in the University of Pennsylvania; Visiting Physician to the White Haven Sanatorium. 11 S. Twenty-first St.

1907. Langdon, H. Maxwell, M.D., Instructor in Ophthalmology in the University of Pennsylvania; Assistant Surgeon to the Dispensary for Diseases of the Eye in the University Hospital; Assistant Ophthalmologist to the Orthopædic Hospital; Chief of the Dispensary for Diseases of the Eye of the Presbyterian Hospital. 2018 Chestnut St.

1887. Leaman, Henry, M.D. 832 N. Broad St.

1904. Le Boutillier, Theodore, M.D., Clinical Professor of Pediatrics in the Woman's Medical College of Pennsylvania; Pediatrist to the Woman's College Hospital; Physician to the Philadelphia Hospital for Contagious Diseases and the Babies' Hospital of Philadelphia. Cynwyd, Pa.

1893. Le Conte, Robert G., A.B., M.D., Surgeon to the Pennsylvania and the Bryn Mawr Hospitals; Consulting Surgeon to Germantown and Gynecean Hospitals. 1530 Locust Street.

1908. Lee, Walter Estell, M.D., Surgeon to the Children's Hospital; Surgeon to the Out-patient Department of the Pennsylvania Hospital; Assistant Surgeon to the Germantown, Bryn Mawr and Orthopædic Hospitals. 905 Pine St.

ELECTED

1903. Leffmann, Henry, A.M., M.D., D.D.S., Ph.D., Professor of Chemistry in the Woman's Medical College of Pennsylvania; Honorary Professor of Chemistry in the Wagner Free Institute of Science; Pathological Chemist to the Jefferson Medical College Hospital. 1839 N. Seventeenth Street.

1892. Leidy, Joseph, M.D., Officer l'instruction publique, France; Consulting Physician to the Pennsylvania Training School for Feeble-minded Children. 1319 Locust St.

1909. L'Engle, Edward M., M.D. Jacksonville, Fla.

1915. Lewis, Fielding O., M.D., Associate in Laryngology in the Jefferson Medical College Hospital; Operating Clinical Chief of the Laryngological Dispensary and Clinical Assistant of the Otological Dispensary of the Jefferson Medical College Hospital; Laryngologist of the Philadelphia General Hospital. 261 S. Seventeenth St.

1877. Lewis, Morris J., M.D., Physician to the Orthopædic Hospital and Infirmary for Nervous Diseases and to the Pennsylvania Hospital. 1316 Locust St.

1911. Lewis, Paul A., M.D., Director of the Pathological Department of the Henry Phipps Institute of the University of Pennsylvania; Assistant Professor of Pathology in the University of Pennsylvania; Director of the Ayer Clinical Laboratory of the Pennsylvania Hospital. Henry Phipps Institute. Seventh and Lombard Streets.

1904. Lindauer, Eugene, M.D., Instructor of Neurology in the Medico-Chirurgical Hospital; Associate in Clinical Medicine in the Philadelphia Polyclinic; Assistant Neurologist to the Philadelphia General Hospital. 2018 N. Thirty-second Street.

1886. Lloyd, J. Hendrie, A.M. (Princeton), M.D., Neurologist to the Philadelphia General Hospital, and to the Methodist Episcopal Hospital; Consulting Neurologist to the State Asylum for the Chronic Insane at Wernersville, and to the Pennsylvania Training School for Feeble-minded Children at Elwyn. 4057 Spruce St.

1907. Lodholz, Edward, M.D., Demonstrator of Physiology in the University of Pennsylvania. 3103 Diamond St.

1893. Longaker, Daniel, M.D., Obstetrician to the Kensington Hospital for Women and Visiting Obstetrician to the Jewish Maternity Hospital. 1402 N. Sixteenth St.

ELECTED

1907. Loux, Hiram R., M.D., Professor of Genito-Urinary Surgery in the Jefferson Medical College; Surgeon to the Philadelphia General Hospital. Medical Arts Building, Sixteenth and Walnut Sts.

1914. Lyon, B. B. Vincent, A.B. (Williams Coll.), M.D. 1901 Pine St.

1900. McCarthy, Daniel J., M.D., Professor of Medical Jurisprudence (George B. Wood Foundation) in the University of Pennsylvania; Neurologist to the Philadelphia General and St. Agnes' Hospitals, and to the Henry Phipps Institute. 2025 Walnut St.

*1903. McConnell, Guthrie, M.D., Director of the Clinical Laboratory of the Waterloo Medical Society; Deputy State Bacteriologist for Waterloo; Assistant Surgeon, Medical Reserve Corps, U. S. N. 508 South St., Waterloo, Iowa.

1913. McCrae, Thomas, B.A., M.D., F.R.C.P. (Lond.), Professor of Medicine in the Jefferson Medical College; Physician to the Jefferson and Pennsylvania Hospitals. 1627 Spruce Street.

1895. McFarland, Joseph, M.D., Sc.D., Professor of Pathology and Bacteriology in the Medical Department of the University of Pennsylvania; Pathologist to the Philadelphia General Hospital. 442 W. Stafford St., Germantown.

1913. McGlinn, John A., B.A., M.D., Assistant Professor of Obstetrics in the Medico-Chirurgical College; Assistant Obstetrician to the Medico-Chirurgical Hospital; Gynecologist to St. Agnes' Hospital. 113 S. Twentieth St.

1905. McKenzie, Robert Tait, A.B., M.D., Professor of Physical Education and Director of the Department of Physical Education in the University of Pennsylvania. 2014 Pine St.

1916. McKnight, Howard A., A.B., M.D., Surgeon of Out-patient Department, St. Mary's Hospital; Assistant Surgeon of Out-patient Department, Polyclinic Hospital. 241 S. Thirteenth St.

1915. McLean, John D., M.D. 1538 S. Broad St.

*1900. McReynolds, Robert Phillips, M.D. 213 S. Broadway, Los Angeles, Cal.

1886. MacCoy, Alexander W., M.D. Consulting Laryngologist to the Bryn Mawr Hospital. 216 S. Fifteenth St.

1910. Mackinney, William H., M.D., Assistant Surgeon to the Dispensary for Genito-urinary Diseases, University Hospital; Assistant in the Urological Dispensary of the Lankenau Hospital. 1701 Chestnut St.

ELECTED

1914. Maier, F. Hurst, M.D., Associate in Gynecology to the Jefferson Medical College; Gynecologist to St. Joseph's Hospital. 2035 Chestnut St.

1913. Major, C. Percy, M.D., Physician to the Dispensary of the Germantown Hospital; Pediatrist to the Dispensary of the Germantown Hospital; Pediatrist to the Abington Memorial Hospital. Tenth and Oak Lane.

1913. Manges, Willis F., M.D., Röntgenologist to the Jefferson Hospital; Director of the Röntgen Ray Laboratory in the Philadelphia General Hospital. 264 S. Sixteenth St.

1898. Marshall, George Morley, M.D., Laryngologist to the Philadelphia General Hospital; Laryngologist and Otologist to St. Joseph's Hospital. 1819 Spruce St.

1889. Martin, Edward, M.D., John Rhea Barton Professor of Surgery in the University of Pennsylvania; Surgeon to the University, Howard, Philadelphia General, and Bryn Mawr Hospitals. 1506 Locust St.

1885. Mays, Thomas J., M.D. 1829 Spruce St.

*1868. Mears, J. Ewing, A.M., M.D., LL.D. 1535 Land Title Building, Broad and Sansom Sts.

*1911. Meigs, Edward Browning, A.B., M.D., Physiologist in the Dairy Division of the United States Department of Agriculture. 1445 Rhode Island Ave., N. W., Washington, D. C.

1914. Mencke, J. Bernhard, A.B., M.D., Assistant Surgeon to the Out-patient Department of the Lankenau Hospital; Assistant Surgeon to the Stetson Hospital. 908 N. Sixteenth Street.

1914. Merrill, Wm. Jackson, A.B., M.D., Instructor in Orthopædic Surgery, University of Pennsylvania; Assistant Orthopædic Surgeon, University Hospital; Orthopædic Surgeon to the Children's Hospital, Children's Seashore House and Howard Hospital; Consulting Orthopædic Surgeon to the Germantown Hospital. Medical Arts Building, Sixteenth and Walnut Sts.

*1894. Miller, D. J. Milton, M.D., Associate Physician to the Children's Hospital, Philadelphia; Pediatrist to the Bamberger Home for Invalid Children, Longport, N. J. N. W. Cor. Pacific and California Aves., Atlantic City, N. J.

1910. Miller, Morris Booth, M.D., Professor of Surgery in the Philadelphia Polyclinic; Surgeon to the Douglass Memorial Hospital; Assistant Surgeon to the Philadelphia General Hospital. 2117 Pine St.

ELECTED

1881. Mills, Charles K., M.D., LL.D., Emeritus Professor of Neurology in University of Pennsylvania; Neurologist to Philadelphia General Hospital; Consulting Physician to the Orthopædic Hospital and Infirmary for Nervous Diseases. 1909 Chestnut Street.

1917. Mitchell, A. Graeme, M.D. 1805 Pine St.

1904. Mitchell, Charles F., M.D., Surgeon to the Germantown, Bryn Mawr, and Chestnut Hill Hospitals, and to the Outpatient Department of the Pennsylvania Hospital. 342 S. Fifteenth St.

1908. Montgomery, Charles M., A.B., M.D., Instructor in the Henry Phipps Institute (University of Pennsylvania); Physician to the Dispensaries of the Pennsylvania and St. Agnes' Hospitals. 2210 Locust St.

1882. Montgomery, Edward E., A.M., M.D., LL.D., Professor of Gynecology in the Jefferson Medical College; Gynecologist to the Jefferson Medical College Hospital and to St. Joseph's Hospital. 1426 Spruce St.

1886. Morris, Caspar, M.D. 2050 Locust St.

1893. Morris, Elliston J., M.D., Physician to the Episcopal Hospital and to the Midnight Mission. 128 S. Eighteenth St.

1883. Morris, Henry, M.D., Professor of Anatomy in the Woman's Medical College of Pennsylvania; Senior Visiting Physician to St. Joseph's Hospital. 313 S. Sixteenth St.

°1856. Morris, J. Cheston, M.D. 1514 Spruce St.

1906. Morrison, William H., M.D. 8021 Frankford Ave.

1897. Morton, Samuel W., M.D. 1926 Chestnut St.

1905. Müller, George P., M.D., Associate in Surgery in the University of Pennsylvania; Assistant Surgeon to the University Hospital; Professor of Surgery in the Philadelphia Polyclinic; Surgeon to St. Agnes' Hospital; Consulting Surgeon to the Chester County Hospital. 1729 Pine St.

1915. Musser, John H., Jr., B.S., M D, Associate in Medicine in the University of Pennsylvania; Physician to the Philadelphia General Hospital; Physician-in-Charge, Medical Dispensary, University Hospital; Dispensary Chief and Assistant in the Presbyterian Hospital. 121 S. Twentieth Street.

1905. Mutschler, Louis H., M.D., Surgeon to the Episcopal Hospital; Assistant Surgeon to the Orthopædic Hospital. 2030 Tioga St.

*1896. Myers, T. D., M.D. P. O. Box 314, Pasadena, Cal.

ELECTED

1902. Nassau, Charles F., M.D., LL.D., Assistant Professor of Surgery in the Jefferson Medical College; Surgeon to St. Joseph's Hospital; Chief Surgeon to the Frankford Hospital; Assistant Surgeon to the Jefferson Medical College Hospital. 1831 Chestnut St.

1886. Neff, Joseph S., A.M., M.D., LL.D., D.P.H. The Blenheim, Seventeenth and Chestnut Streets. Narberth, Pa.

1887. Neilson, Thomas Rundle, A.M., M.D., Surgeon to the Episcopal Hospital and to St. Christopher's Hospital for Children; Professor of Genito-urinary Surgery in the University of Pennsylvania. 1937 Chestnut St.

1905. Newcomet, William S., M.D. 3501 Baring St.

1905. Newlin, Arthur, B.S., M.D., Physician to the Pennsylvania Hospital; Physician to the Dispensary of the Children's Hospital; Assistant Physician to the Orthopædic Hospital. 1804 Pine St.

1899. Nicholson, William Rufus, A.B., M.D., Gynecologist to the Polyclinic and Methodist Episcopal Hospitals; Obstetrician to the Presbyterian Hospital; Associate in Obstetrics in the University of Pennsylvania. 1731 Pine St.

*1889. Noble, Charles P., M.D. Easton, Md.

1898. Nolan, Edward J., M.D., Sc.D., Recording Secretary and Librarian of the Academy of Natural Sciences of Philadelphia. 825 N. Twentieth St.

1905. Norris, Charles C., M.D., Instructor in Gynecology in the University of Pennsylvania; Physician to the Maternity Hospital; Consultant Gynecologist and Obstetrician to the Henry Phipps Institute of the University of Pennsylvania; Assistant Gynecologist to University Hospital. 1503 Locust St.

1905. Norris, George William, A.B., M.D., Assistant Professor of Medicine in the University of Pennsylvania; Physician to the Pennsylvania Hospital; Assistant Physician to the University Hospital. 1530 Locust St.

*1901. Norris, Henry, M.D., Surgeon to the Rutherford Hospital. Rutherfordton, N. C.

*1865. Norris, Isaac, M.D. Fairhill, Bryn Mawr, Pa.

1892. Norris, Richard C., M.D., Lecturer on Clinical and Operative Obstetrics in the University of Pennsylvania; Obstetrician in Charge of the Preston Retreat; Visiting Obstetrician to the Philadelphia General Hospital; Gynecologist to the Methodist Episcopal Hospital, and Consulting Obstetrician and Attending Gynecologist to the Southeastern Dispensary and Hospital. 500 N. Twentieth St.

ELECTED

1913. O'Neal, Alexander H., A.B., A.M., M.D., Physician to the Cathcart and Richardson Homes, Devon; Anesthetizer to the Bryn Mawr Hospital. St. Davids, Pa.

[D]1885. Osler, Sir William, Bart., M.D., Regius Professor of Medicine in Oxford University, England. No. 7, Norham Gardens, Oxford, England.

1903. Ostheimer, Maurice, A.B., M.D., Associate in Pediatrics in the University of Pennsylvania; Visiting Physician to the Philadelphia Hospital for Contagious Diseases; Physician-in-Charge of the Children's Dispensary and Assistant Visiting Pediatric Physician, University Hospital; Physician to the Medical Dispensary of the Children's Hospital. 2039 De Lancey St.

1913. Outerbridge, George W., A.B., M.D., Instructor in Gynecology and in Surgical Pathology in the University of Pennsylvania; Assistant Gynecologist to the Methodist Hospital and Assistant Surgeon to the Gynecean Hospital. 2040 Chestnut St.

1915. Owen, Hubley R., M.D., Surgeon to the Philadelphia General Hospital; Assistant Surgeon to the Orthopædic Hospital; Chief Surgeon of the Bureaus of Police and Fire, Philadelphia. 2046 Pine St.

1897. Packard, Francis R., M.D., Surgeon to the Out-patient Department for Diseases of the Ear, Throat, and Nose of the Pennsylvania Hospital; Laryngologist to the Children's Hospital of Philadelphia; Consulting Aurist to the Bryn Mawr Hospital. 304 S. Nineteenth St.

1898. Page, Henry F., M.D., Assistant Physician to the Lankenau Hospital and Physician to the Medical Dispensary of the same; Clinical Professor of Medicine in the Woman's Medical College of Pennsylvania. 315 S. Sixteenth St.

1906. Pancoast, Henry K., M.D., Professor of Röntgenology in the University of Pennsylvania and Röntgenologist to the University Hospital. Bala, Pa.

1909. Parish, Benjamin D., B.S., M.D., Assistant Instructor in Otology in the University of Pennsylvania; Assistant Surgeon to the Dispensary for Diseases of the Ear, University Hospital; Aurist and Laryngologist to St. Agnes' Hospital. Medical Arts Building, N. W. Cor. Sixteenth and Walnut Sts.

ELECTED

1899. Parke, William E., M.D., Consulting Obstetrician to the Episcopal Hospital; Associate Surgeon to the Kensington Hospital for Women; Gynecologist to the Frankford Hospital. 1739 N. Seventeenth St.

1910. Patterson, Ross Vernet, M.D., Dean, Jefferson Medical College; Assistant Professor of Medicine in the Jefferson Medical College; Physician to the Philadelphia Hospital; Assistant Physician to the Jefferson Hospital. 340 S. Sixteenth St.

1903. Pearce, Richard M., M.D., Sc.D., Professor of Research Medicine in the University of Pennsylvania. 2114 De Lancey Place.

1909. Pemberton, Ralph, M.S., M.D., Visiting Physician to the Presbyterian Hospital; Director of the Department of Clinical Chemistry in the Pathological Laboratory of the Presbyterian Hospital. 2224 Locust St.

†1889. Penrose, Charles Bingham, M.D., Ph.D. (Harvard), Formerly Professor of Gynecology in the University of Pennsylvania. 1720 Spruce St.

1914. Pepper, O. H. Perry, B.S. (Univ. of Penna.), M.D. 1811 Spruce St.

†1902. Pepper, William, M.D., Dean of the School of Medicine, and Assistant Professor of Clinical Pathology in the University of Pennsylvania; Physician to the Philadelphia General Hospital; Assistant Physician to the University Hospital. 1811 Spruce St.

1916. Percival, Milton Fraser, M.D. 2332 S. Broad St.

1917. Peter, Luther C., M.D. 1527 Spruce St.

1912. Petty, Orlando H., B.S., A.M., M.D., Instructor in Medicine in the Jefferson Medical College; Pathologist and Assistant Physician to St. Timothy's Hospital; Physician to the Kensington Dispensary for the Treatment of Tuberculosis. 6215 Ridge Ave.

1905. Pfahler, George E., M.D., Director of the Röntgen Ray Laboratory of Medico-Chirurgical Hospital. 1321 Spruce St.

1915. Pfeiffer, Damon B., A.B., M.D., Instructor in Surgery, University of Pennsylvania; Assistant Surgeon, University Hospital; Pathologist to the Lankenau Hospital; Director of the Clinical Laboratory, Presbyterian Hospital. 2028 Pine St.

1907. Pfromm, George W., Ph.G., M.D., Assistant Physician to the American Stomach Hospital; Consulting Physician to the German Protestant Home for the Aged. 1431 N. Fifteenth St.

ELECTED

1907. Phillips, Horace, M.D., Second Assistant Physician to the Pennsylvania Hospital for the Insane; Visiting Physician to the Eastern Penitentiary of Pennsylvania. 4713 Baltimore Ave.

1883. Piersol, George A., M.D., Sc.D., Professor of Anatomy in the University of Pennsylvania. 4724 Chester Ave.

1911. Piersol, George Morris, B.S., M.D., Professor of the Principles and Practice of Medicine in the Woman's Medical College of Pennsylvania; Associate in Medicine in the University of Pennsylvania; Physician to the Philadelphia General Hospital; Assistant Physician to the University Hospital. 1913 Spruce St.

1917. Piper, Edmund Brown, M.D. 6071 Drexel Road, Overbrook, Pa.

1905. Pitfield, Robert L., M.D., Pathologist to the Germantown Hospital; Bacteriologist to the Chestnut Hill Hospital for Lung Diseases. 5211 Wayne Ave.

1896. Posey, William Campbell, M.D., Surgeon to the Wills Eye Hospital; Professor of Ophthalmology in the Philadelphia Polyclinic and College for Graduates in Medicine; Ophthalmic Surgeon to the Howard Hospital; Ophthalmologist to the Pennsylvania Hospital for Epileptics. 2049 Chestnut St.

1899. Potts, Charles S., M.D., Neurologist to the Philadelphia General Hospital; Consultant to the Insane Department of the Philadelphia General Hospital; Consulting Neurologist, Lankenau Hospital; Consultant to the Hospital for the Insane, Atlantic County, New Jersey. 2018 Chestnut St.

1907. Price, George E., M.D., Associate Professor of Nervous and Mental Diseases in the Jefferson Medical College; Neurologist to the Philadelphia General Hospital. 1830 S. Rittenhouse Square.

†1903. Pyle, Walter L., A.M., M.D., Assistant Surgeon to the Wills Eye Hospital. 1931 Chestnut St.

1908. Radcliffe, McCluney, A.M. (Lafayette), M.D., LL.D., Ophthalmic Surgeon to the Presbyterian Hospital; Attending Surgeon to the Wills Eye Hospital. 1906 Chestnut St.

1913. Randall, Alexander, A.M., M.D., Assistant Instructor in Surgery in the University of Pennsylvania; Assistant Surgeon in the Genito-Urinary Dispensary of the University of Pennsylvania. Professional Building, Room 401.

ELECTED

1887. Randall, B. Alexander, M.A., M.D., Professor of Otology in the University of Pennsylvania; Ear Surgeon to the Children's Hospital; Consulting Aurist to the Pennsylvania Institution for the Deaf and Dumb, and to St. Timothy's Hospital. 1717 Locust St.

*1904. Ravenel, Mazyck P., M.D., Professor of Preventive Medicine and Bacteriology and Director of the Public Health Laboratory at the University of Missouri, Columbia, Mo.

1897. Rhein, John H. W., M.D., Professor of Diseases of the Mind and Nervous System in the Philadelphia Polyclinic and College for Graduates in Medicine; Neurologist to the Howard Hospital; Physician to the Philadelphia Home for Incurables; Bacteriologist to the Pennsylvania Training School for Feeble-minded Children. 1732 Pine St.

1906. Rhein, Robert D., M.D., Chief Physician to the Clinic of the American Hospital for Diseases of the Stomach; Physician to the Philadelphia Home for Incurables; Examining Physician to the White Haven Sanatorium. 2016 Pine Street.

1891. Rhoads, Edward G., M.D. 159 W. Coulter St., Germantown.

1910. Rhoads, Samuel, M.D. 152 Schoolhouse Lane, Germantown.

1898. Riesman, David, M.D., Professor of Clinical Medicine in the University of Pennsylvania; Professor of Clinical Medicine in the Philadelphia Polyclinic; Physician to the Philadelphia General and Polyclinic Hospitals. 1715 Spruce Street.

1895. Ring, G. Oram, A.M., M.D., Ophthalmic Surgeon to the Episcopal Hospital; Ophthalmologist to the Widener Memorial Home for Crippled Children; Consulting Ophthalmologist to the American Oncologic Hospital. N. E. Cor. Seventeenth and Walnut Sts.

*1905. Risley, J. Norman, M.D., Assistant Surgeon to the Wills Eye Hospital; Ophthalmologist to the Pennsylvania Training School for Feeble-minded Children. 36 Seventh St., New Bedford, Mass.

1891. Risley, Samuel D., A.M., M.D., Ph.D., Consulting Surgeon to the Wills Eye Hospital; Professor (Emeritus) of Ophthalmology in the Philadelphia Polyclinic and College for Graduates in Medicine; Alumnus Manager of the University Hospital. 2018 Chestnut St.

†1878. Roberts, John B., M.D., Professor of Surgery in the Philadelphia Polyclinic. 313 S. Seventeenth St.

ELECTED

1899. Roberts, Walter, M.D., Professor of Otology in the Philadelphia Polyclinic; Otologist to the Methodist Episcopal Hospital; Laryngologist to the Philadelphia General Hospital. 1732 Spruce St.

1903. Robertson, William Egbert, M.D., Professor of Theory and Practice of Medicine and of Clinical Medicine in Temple University; Physician to the Episcopal, Samaritan, and Garretson Hospitals. 327 S. Seventeenth St.

1902. Robinson, James Weir, M.D., Assistant Surgeon to the Presbyterian Hospital. 326 S. Sixteenth St.

1903. Robinson, William Duffield, Ph.G., M.D. 2012 Mount Vernon St.

1912. Rodman, John Stewart, M.D., Lecturer on Surgery in the Medico-Chirurgical College; Assistant Surgeon to the Medico-Chirurgical Hospital; Surgeon to the Dispensary of the Presbyterian Hospital; Assistant Surgeon to the Out-patient Department of the Pennsylvania Hospital. 2106 Walnut St.

1909. Rosenberger, Randle C., M.D., Professor of Hygiene and Bacteriology in the Jefferson Medical College; Professor of Hygiene and Preventive Medicine in the Woman's Medical College of Pennsylvania; Director of the Clinical Laboratory of the Philadelphia General Hospital. 2330 N. Thirteenth St.

1898. Ross, George G., M.D., Assistant Surgeon to the Lankenau Hospital and Surgeon to the Out-patient Department of the same; Surgeon to the Germantown Hospital; Surgeon to the Stetson Hospital; Instructor in Surgery in the University of Pennsylvania. 1721 Spruce St.

*1907. Royer, B. Franklin, M.D. Donaldson Bldg., Harrisburg, Pa.

†1905. Rugh, James Torrance, A.B., M.D., Clinical Professor of Orthopedic Surgery in the Woman's Medical College of Pennsylvania; Orthopedic Surgeon to the Jefferson Medical College; Orthopedic Surgeon to the Methodist and the Philadelphia General Hospitals. 1616 Spruce St.

1897. Sailer, Joseph, Ph.B., M.D., Professor of Clinical Medicine in Universtiy of Pennsylvania; Physician to the Philadelphia General, the University, and Presbyterian Hospitals. 1718 Spruce St. .

ELECTED

1900. Sajous, Charles E. de M., M.D., B.Lett., LL.D., Knight of the Legion of Honor, and Officer of the Academy of France; Corresponding Member of the Society of Public Medicine of Belgium. 2043 Walnut St.

1905. Sartain, Paul J., M.D. 2006 Walnut St.

1908. Sautter, Albert C., M.D., Assistant in the Dispensary for Diseases of the Eye in the University Hospital; Assistant in the Eye Dispensary of the Lankenau Hospital. 1421 Locust St.

1906. Saylor, Edwin S., M.D., Chief Ophthalmic Surgeon to the Charity Hospital of Philadelphia, and to the Department Eye and Ear, American Hospital for Diseases of the Stomach. 2005 Chestnut St.

*1910. Scarlet, Rufus B., M.D., Laryngologist to the Home for Consumptives at Chestnut Hill; Assistant in the Department for Diseases of the Ear, Throat, and Nose of the Pennsylvania Hospital; Instructor in Diseases of the Nose and Throat in the Philadelphia Polyclinic and College for Graduates in Medicine. 78 N. Clinton Ave., Trenton, N.J.

1917. Schaeffer, Jacob Parsons, A.M., M.D., Ph.D., Professor of General Anatomy and Director of the Daniel Baugh Institute of Anatomy of the Jefferson Medical College. 4634 Spruce St.

1899. Schamberg, Jay F., M.D., Professor of Dermatology and Infectious Eruptive Diseases in the Philadelphia Polyclinic and College for Graduates in Medicine; Assistant Physician to the Municipal Hospital for Infectious Diseases. 1922 Spruce St.

1917. Schaubel, Trueman Gross, M.D. 1805 Pine St.

1917. Schoff, Charles H., M.D. Media, Pa.

1887. de Schweinitz, George Edmund, A.M., M.D., LL.D., Professor of Ophthalmology in the University of Pennsylvania; Consulting Ophthalmic Surgeon to the Orthopædic Hospital and Infirmary for Nervous Diseases; The Philadelphia Polyclinic and School for Graduates in Medicine, and the Philadelphia General Hospital; Ophthalmic Surgeon to the University Hospital. 1705 Walnut St.

*1913. de Schweinitz, George Lord, B.S., M.D. 169 East Broad St., Bethlehem, Pa.

1910. Schwenk, Peter N. K., M.A., M.D., Attending Surgeon to the Eye Department of the Pennsylvania Hospital; Attending Surgeon to the Wills Eye Hospital. 1417 N. Broad Street.

ELECTED

1892. Seiss, Ralph W., M.D., Professor of Otology in the Philadelphia Polyclinic; Consulting Laryngologist to the Pennsylvania Institution for the Deaf and Dumb. 255 S. Seventeenth St.

1917. Service, Charles A., M.D. Bala, Pa.

1908. Shannon, Charles E. G., A.B., M.D., Instructor in Ophthalmology in the Jefferson Medical College; Assistant in the Ophthalmological Clinic at the Jefferson Medical College Hospital; Ophthalmologist to the Seybert Institution. 1633 Spruce St.

1897. Sharpless, William T., M.D., Physician to the Chester County Hospital. West Chester, Pa.

1906. Shields, William G., M.D., Dermatologist to Germantown Hospital; Chief of Dermatological Clinic and Assistant Physician to the Jewish Hospital. 414 School Lane, Germantown.

1890. Shoemaker, George Erety, A.M., M.D., Gynecologist to the Presbyterian Hospital and to the Pennsylvania Epileptic Hospital and Colony Farm. 1831 Chestnut St.

*1908. Shoemaker, Harlan, A.B., M.D., Lecturer in Surgery, University of Southern California, Surgeon to Los Angeles County Hospital, Surgeon to Washington Street Clinic. 621 Marsh Strong Building, Los Angeles, Cal.

†1893. Shoemaker, Harvey, M.D., Visiting Physician to the Sheltering Arms; Consulting Physician to the Southern Home for Destitute Children; Assistant Physician to the Lankenau Hospital; Physician to the Out-patient Department of the Lankenau Hospital. 2011 Chestnut St.

†1896. Shoemaker, William T., M.D., Associate Clinical Professor of Ophthalmology in the Woman's Medical College of Pennsylvania; Ophthalmic Surgeon to the Germantown and Lankenau Hospitals; Attending Surgeon to the Eye Department of the Pennsylvania Hospital; Consulting Ophthalmologist to the Pennsylvania Institution for the Deaf and Dumb, and to the Southern Home for Destitute Children. 109 S. Twentieth St.

1900. Shumway, Edward Adams, B.S., M.D., Ophthalmic Surgeon to the Philadelphia General Hospital; Ophthalmic Surgeon to the Children's Hospital; Instructor in Ophthalmology in the University of Pennsylvania, and Assistant Ophthalmic Surgeon to the University Hospital; Ophthalmic Surgeon to the Lankenau Hospital. 2046 Chestnut St.

ELECTED

1903. Sinclair, John Falconer, M.D., Physician to the Medical Dispensary of the Presbyterian Hospital; Physician to the Philadelphia Orphan Asylum and to the Presbyterian Orphanage; Physician to the Home of the Merciful Saviour for Crippled Children. 4103 Walnut St.

1907. Sinkler, Francis Wharton, A.B., M.D., Physician to the Orthopædic Hospital and Infirmary for Nervous Diseases; Physician to the Episcopal Hospital. 1606 Walnut St.

1902. Siter, E. Hollingsworth, M.D., Instructor in Genito-urinary Diseases in the University of Pennsylvania; Genito-urinary Surgeon to the Philadelphia General Hospital; Surgeon-in-Charge of the Genito-urinary Dispensary of the University Hospital; Consulting Genito-Urinary Surgeon to the Eastern Penitentiary, and to the Philadelphia County Prison. 1818 S. Rittenhouse Square.

1904. Skillern, Penn-Gaskell, M.D. 241 S. Thirteenth St.

1904. Smith, Allen J., A.M., M.D., Sc.D. (Penna. Coll.), LL.D. (McGill Univ.), Professor of Pathology and of Comparative Pathology, and Director of Courses in Tropical Medicine in the University of Pennsylvania. Medical Laboratories, University of Pennsylvania.

1905. Smith, S. MacCuen, M.D., Professor of Otology in the Jefferson Medical College; Aurist and Laryngologist to the Germantown Hospital; Aurist to the Jewish Hospital; Consulting Aurist to the Oncologic Hospital. 218 W. Chelten Ave., Germantown.

1908. Speese, John, M.D., Instructor in Surgery and Surgical Pathology in the University of Pennsylvania; Associate in Surgery in the Philadelphia Polyclinic; Surgeon to the Children's Hospital; Assistant Surgeon to the Presbyterian and Polyclinic Hospitals. 2206 Locust St.

1895. Spellissy, Joseph M., A.M., M.D., Visiting Surgeon to St. Joseph's and to the Methodist Episcopal Hospitals; Assistant Surgeon to the Orthopedic Department of the University Hospital. 317 S. Fifteenth St.

1897. Spiller, William G., M.D., Professor of Neurology in the University of Pennsylvania; Clinical Professor of Nervous Diseases in the Woman's Medical College of Pennsylvania; Neurologist to the Philadelphia General Hospital; Consultant Neurologist to the Pennsylvania Hospital. 4409 Pine St.

ELECTED

1894. Stahl, B. Franklin, B.S., Ph.G., M.D., Clinical Professor of Medicine in the Woman's Medical College of Pennsylvania; Associate in Medicine and Lecturer on Dietetics of the Sick in the University of Pennsylvania; Visiting Physician to St. Agnes' and the Philadelphia General Hospitals. 1727 Pine St.

1909. Starbuck, J. Clinton, M.D., Physician to the Orphanage, Orphan Society of Philadelphia at Wallingford and to the Glen Mills School, Glen Mills, Pa. 42 E. Washington St., Media, Pa.

*1875. Starr, Louis, M.D., LL.D. (Haverford). Care of Brown, Shipley & Co., London, England.

1912. Stauffer, Nathan Pennypacker, D.D.S., M.D., Laryngologist and Otologist to the Dispensary of the Presbyterian Hospital; to the Pennsylvania Hospital; to the Philadelphia General Hospital, Tubercular Department; to the Home for Crippled Children. 218 S. Twentieth St.

1910. Stellwagen, Thomas C., Jr., M.D., Chief Clinical Assistant in the Out-patient Surgical Department of the Jefferson Medical College Hospital. 200 Professional Bldg., 1831 Chestnut St.

1884. Stelwagon, Henry W., M.D., Ph.D., Professor of Dermatology in the Jefferson Medical College. 1634 Spruce St.

1895. Stengel, Alfred, M.D., Sc.D., Professor of Medicine in the University of Pennsylvania; Physician to the University Hospital and the Pennsylvania Hospital. 1728 Spruce Street.

1901. Stevens, Arthur A., M.D., Professor of Materia Medica, Therapeutics, and Clinical Medicine in the Woman's Medical College of Pennsylvania; Lecturer on Physical Diagnosis in the University of Pennsylvania; Physician to the Episcopal and St. Agnes' Hospitals. 314 S. Sixteenth St.

1902. Stewart, Francis T., M.D., Professor of Clinical Surgery in the Jefferson Medical College; Surgeon to the Germantown Hospital; Surgeon to the Pennsylvania Hospital. 311 S. Twelfth St.

1914. Stewart, Thomas S., B.S. (Univ. of Penna.), M.D. 301 S. Eighteenth St.

1898. Stout, George C., M.D., Professor of Otology in the Philadelphia Polyclinic and College for Graduates in Medicine; Laryngologist and Aurist to the Presbyterian Hospital, the Children's Aid Society, and the William Penn Charter School. 1611 Walnut St.

ELECTED

1884. Stryker, Samuel S., M.D., Physician to the Presbyterian Hospital. 3833 Walnut St.

*1900. Swan, John M., M.D. 457 Park Avenue, Rochester, N. Y.

1898. Sweet, William M., M.D., Clinical Professor of Ophthalmology in the Jefferson Medical College, and Ophthalmic Surgeon to the Jefferson Medical College Hospital; Professor of Diseases of the Eye in the Philadelphia Polyclinic; Attending Surgeon to the Wills Eye Hospital. 1205 Spruce St.

1900. Talley, James Ely, A.B., M.D., Visiting Physician to the Presbyterian and Methodist Episcopal Hospitals; Consulting Physician to the Eastern Penitentiary. 218 S. Twentieth Street.

1911. Taylor, Alonzo Englebert, M.D., Rush Professor of Physiological Chemistry in the University of Pennsylvania. 4522 Locust St.

1886. Taylor, John Madison, A.B. and A.M. (Princeton), M.D., Professor of Applied Therapeutics in the Temple University; Editor *Monthly Cyclopedia of Practical Medicine;* Consulting Physician to the Elwyn, Pa., and the Vineland, N. J., Training Schools for Feeble-minded Children. 1504 Pine St.

1887. Taylor, William J., M.D., Surgeon to the Orthopædic Hospital and Infirmary for Nervous Diseases, and to St. Agnes' Hospital; Consulting Surgeon to the West Philadelphia Hospital for Women. 1825 Pine St.

1886. Taylor, William L., M.D. 1340 N. Twelfth St.

†1910. Thomas, Benjamin A., A.M., M.D., Professor of Genito-urinary Surgery in the Philadelphia Polyclinic and College for Graduates in Medicine; Instructor in Surgery in the University of Pennsylvania; Surgeon-in-Chief to the Outpatient Department of the University Hospital. 116 S. Nineteenth St.

1867. Thomas, Charles Hermon, M.D. 3634 Chestnut St.

1912. Thomas, Frank Wister, A.M., M.D., Visiting Physician to "Buttercup Cottage;" Consulting Physician to the Germantown Hospital. 27 E. Mt. Airy Ave.

1907. Thomas, Thomas Turner, M.D., Associate Professor of Applied Anatomy, and Associate in Surgery in the University of Pennsylvania; Surgeon to the Philadelphia General Hospital; Assistant Surgeon to the University Hospital. 2005 Chestnut St.

ELECTED

1896. Thorington, James, A.M., M.D., Professor of Diseases of the Eye in the Philadelphia Polyclinic and College for Graduates in Medicine; Ophthalmic Surgeon to the Presbyterian Hospital; Ophthalmologist to the Ellwyn, Pa., Training School for Feeble-minded Children. 2031 Chestnut St.

1898. Thornton, Edward Q., M.D., Assistant Professor of Materia Medica in the Jefferson Medical College. 1331 Pine St.

1912. Torrey, Robert G., M.D., Assistant Physician to the Philadelphia General Hospital; Physician to the State Tuberculosis Dispensary. 1716 Locust St.

1896. Toulmin, Harry, M.D. Haverford, Pa.

1908. Tracy, Stephen E., M.D., Gynecologist to the Stetson Hospital; Visiting Surgeon to the Gynecean Hospital. 1527 Spruce St.

1901. Tucker, Henry, M.D., Genito-urinary Surgeon to the Philadelphia General Hospital; Curator of the Academy of Natural Sciences of Philadelphia. 2000 Pine St.

†1894. Tunis, Joseph Price, M.D., Clinical Assistant to the Nose and Throat Dispensary of the Polyclinic Hospital. The Gladstone, Eleventh and Pine Sts.

1901. Turner, John B., M.D. 1833 Chestnut St.

1866. Tyson, James, M.D., LL.D., Emeritus Professor of Medicine in the University of Pennsylvania and late Physician to the Hospital of the University of Pennsylvania, and to the Pennsylvania Hospital. 1506 Spruce St.

1897. Tyson, T. Mellor, M.D., Physician to the Philadelphia General Hospital; Physician to the Rush Hospital, the Philadelphia Lying-in-Charity Hospital, and the Children's Aid Society of Philadelphia. 1506 Spruce St.

1907. Ullom, Josephus Tucker, M.A., M.D., Member of the Staff of the Henry Phipps Institute, Visiting Physician to the Chestnut Hill Hospital. 24 Carpenter St., Germantown.

1913. Vail, William Penn., B.S., M.S., M.D., Laryngologist to the Pennsylvania Institution for the Instruction of the Blind; Laryngologist to the Department for Tuberculosis of the Philadelphia General Hospital; Assistant Laryngologist and Otologist to the Out-patient Department of the Pennsylvania Hospital; Assistant Laryngologist to the Children's Hospital. 1700 Walnut St.

ELECTED

[D]1873. Van Harlingen, Arthur, Ph.B. (Yale), M.D., Emeritus Professor of Diseases of the Skin in the Philadelphia Polyclinic. 1831 Chestnut St.

1903. Van Pelt, William Turner, M.D. Consulting Ophthalmologist to the Episcopal Hospital. 1100 Widener Building.

1893. Vansant, Eugene Larue, M.D., Professor of Diseases of the Throat and Nose in the Philadelphia Polyclinic; Visiting Physician to the Throat, Nose, and Ear Department of the Howard Hospital. 1929 Chestnut St.

1912. Vaux, Norris Wistar, M.D., Surgeon to the Chestnut Hill Hospital; Surgeon to the Dispensary of the Germantown Hospital. 8901 Germantown Ave., Chestnut Hill.

*1897. Veasey, Clarence A., A.M., M.D. Suite 404, Paulsen Building, Spokane, Wash.

†1883. Vinton, Charles Harrod, A.M., M.D. P. O. Box 464, Atlantic City, N. J.

1903. Wadsworth, William Scott, M.D. 3914 Baltimore Ave.

1906. Walker, John K., M.D., Physician to the Children's Hospital of the Mary J. Drexel Home; Physician to the Out-patient Department of the Pennsylvania Hospital. 1915 Rittenhouse St.

1907. Walker, Warren, M.D., Dermatologist to the Episcopal and Howard Hospitals; Assistant Dermatologist to the Pennsylvania Hospital. 246 S. Twenty-second St.

1904. Walsh, Joseph, A.M., M.D., Visiting Physician to and Medical Director of the White Haven Sanatorium; Medical Director of St. Agnes' Hospital. 2026 Chestnut St.

1910. Ward, E. Tillson, A.M., M.D. 1415 S. Broad St.

1895. Watson, Arthur W., M.D., Professor of Diseases of the Throat and Nose in the Philadelphia Polyclinic and College for Graduates in Medicine; Laryngologist to the Jewish Hospital; Laryngologist and Aurist to the Mt. Sinai Hospital; Laryngologist to Home for Incurables. 126 S. Eighteenth Street.

1886. Watson, Edward W., M.D., Physician to the Magdalene Home. 38 S. Nineteenth St.

1903. Weber, Charles H., M.D., Physician to the Dispensary of the Children's Hospital. 2048 Pine St.

1906. Weisenburg, Theodore H., M.D., Professor of Clinical Neurology and of Neuropathology in the Medico-Chirurgical College; Neurologist to the Philadelphia General Hospital;

ELECTED

Consulting Neurologist to the State Hospital for the Insane at Norristown, and to the State Hospital for the Feeble-minded and Epileptic at Spring City. 1909 Chestnut St.

1883. Welch, William M., M.D., Chief Diagnostician to the Bureau of Health, and Consulting Physician to the Municipal Hospital for Contagious Diseases; Consulting Physician to the Northern Dispensary and the Northern Home for Friendless Children. 1411 Jefferson St.

1916. Welker, Henry C., Ph.B., A.M., M.D., Surgeon to Charity Hospital, Norristown, Pa.; Consulting Surgeon to the Norristown State Hospital for the Insane. 831 De Kalb St., Norristown, Pa.

1913. Wells, P. Frailey, A.M., M.D., Ph.D. S. W. Cor. Fortieth and Brown Sts.

1897. Wells, William H., M.D., Assistant Professor of Obstetrics in the Jefferson Medical College; Assistant Obstetrician to the Jefferson Medical College Hospital; Pediatrician to the Willing Day Nursery; Pediatrician to the Charity Hospital. 1135 Spruce St.

1893. Westcott, Thompson S., M.D., Associate in Diseases of Children in the University of Pennsylvania; Pediatrist to the Methodist Episcopal Hospital; Assistant Physician to the Children's Hospital; Pediatrist to the Jewish Hospital. 1720 Pine St.

1884. Wharton, Henry R., M.D., Surgeon to the Presbyterian and the Children's Hospitals; Surgeon to Girard College; Consulting Surgeon to the Bryn Mawr Hospital, the Chestnut Hill Hospital, St. Christopher's Hospital for Children, the Pennsylvania Institution for the Deaf and Dumb, and the Pennsylvania Institution for the Blind. 1725 Spruce Street.

1901. White, Courtland Y., M.D., Director of the Pathological Laboratories of the Episcopal Hospital; Pathologist to the Children's Hospital and to the Kensington Hospital for Women; Chief Bacteriologist to the Bureau of Health, Department of Health and Charities, Philadelphia. 1808 Diamond St.

1905. Whiteway, Harold M., M.D. 1924 Chestnut St.

1898. Whiting, Albert D., M.D., Surgeon to the Germantown Hospital; Assistant Surgeon to the Lankenau Hospital; Assistant Surgeon to the University Hospital; Instructor in Surgery in the University of Pennsylvania. 1523 Spruce Street.

ELECTED

1914. Willard, de Forest P., B.S. (Univ. of Penna.), M.D. 1933 Chestnut St.

1907. Williams, Carl, B.S., M.D., Ophthalmic Surgeon to the Germantown Hospital; Instructor in Ophthalmology in the University of Pennsylvania; Ophthalmic Surgeon to the Pennsylvania Institution for the Deaf and Dumb. School Lane and Greene Sts., Germantown.

1915. Willits, Charles H., A.M., M.D., Medical Director of the Provident Life and Trust Company. Rittenhouse Hotel, Twenty-second and Chestnut Sts.

1916. Wilmer, Harry B., M.D., Assistant Instructor in Medicine, University of Pennsylvania; Assistant Visiting Physician and Assistant Neurologist to the Germantown Hospital; Visiting Chief to the Dispensary of the Germantown Hospital. 138 W. Walnut Lane, Germantown.

1881. Wilson, H. Augustus, M.D., Professor of Orthopedic Surgery in the Jefferson Medical College; Emeritus Professor of Orthopedic Surgery in the Philadelphia Polyclinic; Consulting Orthopedic Surgeon to the Philadelphia Lying-in Charity Hospital and the Kensington Hospital for Women; Orthopedic Surgeon to St. Agnes' Hospital. 1611 Spruce St.

1874. Wilson, James Cornelius, A.M. (Princeton), M.D., Emeritus Professor of the Practice of Medicine and of Clinical Medicine in the Jefferson Medical College; Physician-in-Chief to the Lankenau Hospital; Emeritus Physician to the Pennsylvania Hospital; Consulting Physician to the Bryn Mawr Hospital. 1509 Walnut St.

1902. Wilson, Samuel M., M.D. 1517 Arch St.

1897. Wilson, W. Reynolds, M.D. 1709 Spruce St.

1904. Wister, James W., M.D., Physician to the Out-patient Department of the Germantown Hospital. 5430 Germantown Ave.

*1901. Witmer, A. Ferree, M.D. Freeport, Long Island, N. Y.

1893. Wood, Alfred C., M.D., Assistant Professor of Surgery in the University of Pennsylvania; Surgeon to the University, the Philadelphia General, St. Timothy's, and the Howard Hospitals. 2035 Walnut St.

1900. Wood, George B., M.D., Instructor in Laryngology in the University of Pennsylvania; Assistant in the Clinic for Diseases of the Nose and Throat at the Polyclinic Hospital. 129 S. Eighteenth St.

ELECTED

1865. Wood, Horatio C, M.D., LL.D (Yale, Lafayette and University of Pennsylvania), M. N. A. S., Emeritus Professor of Materia Medica and Therapeutics in the University of Pennsylvania. 4107 Chester Ave.

1903. Wood, Horatio C., Jr., M.D., Professor of Pharmacology and Therapeutics in the University of Pennsylvania. 1905 Chestnut St.

1880. Woodbury, Frank, M.D., Secretary to the Committee on Lunacy of the Board of Charities of Pennsylvania. 218 S. Sixteenth St.

*1911. Woods, Andrew H., A.B., M.D., Neurologist to the Canton Hospital and to the Canton Hospital for Women; Acting President and Medical Superintendent of the Canton Christian College. Canton Christian College, Canton, China.

†1897. Woodward, George, M.D. W. Willow Grove Ave., Chestnut Hill, Philadelphia.

1913. Woodward, W. Wellington, M.D. 26 S. Church St., West Chester, Pa.

1903. Worden, Charles B., M.D., Medical Director Wanamaker Stores. 322 S. Sixteenth St.

1889. Young, James K., M.D., Professor of Orthopedic Surgery in the Philadelphia Polyclinic; Clinical Professor of Orthopedic Surgery in the Woman's Medical College of Pennsylvania; Associate Professor of Orthopedic Surgery in the University of Pennsylvania. 222 S. Sixteenth St.

1894. Zentmayer, William, M.D., Professor of Ophthalmology in the Philadelphia Polyclinic and College for Graduates in Medicine; Attending Surgeon to the Wills Eye Hospital; Ophthalmologist to the Glen Mills School. 1506 Spruce St.

1899. Ziegler, S. Lewis, A.M., M.D., LL.D., Attending Surgeon to the Wills Eye Hospital; Chief Ophthalmic Surgeon to St. Joseph's Hospital; Membre Société Française d'Ophthalmologie; Director of Public Health and Charities of Philadelphia. 1625 Walnut St.

1887. Ziegler, Walter M. L., A.M., M D. 1418 N. Seventeenth St.

1895. Zimmerman, Mason W., M.D., Consulting Ophthalmic Surgeon to the Germantown Hospital. 1522 Locust St.

ASSOCIATE FELLOWS

(Limited to Fifty, of whom Twenty may be Foreigners)

AMERICAN

ELECTED

1911. ABBE, ROBERT, M.D. 13 W. Fiftieth St., New York City, N. Y.

1909. BILLINGS, FRANK, M.D., 122 S. Michigan Boulevard, Chicago, Illinois.

1893. COUNCILMAN, WILLIAM T., M.D., Harvard Medical College, Boston, Massachusetts.

1909. CRILE, GEORGE W., M.D., 1021 Prospect Avenue, S. E., Cleveland, Ohio.

1909. DANA, CHARLES LOOMIS, M.D., 53 West Fifty-third Street, New York City, New York.

1892. EMMET, THOMAS ADDIS, M.D., 91 Madison Avenue, New York City, New York.

1903. GORGAS, WILLIAM C., M.D., U. S. A., Washington, D. C.

1891. JACOBI, A., M.D., 19 East Forty-seventh Street, New York City, New York.

1912. MCCAW, LIEUT. COL. WALTER D., M.D. Care of Surgeon-General's Office, Washington, D. C.

1909. MALL, FRANKLIN P., M.D., 1514 Bolton Street, Baltimore, Maryland.

1906. MAYO, WILLIAM J., M.D., Rochester, Minnesota.

1906. PILCHER, LEWIS STEPHEN, M.D., 145 Gates Avenue, Brooklyn, New York.

1886. REEVE, JOHN C., M.D., LL.D., S. W. corner Third and Wilkinson Streets, Dayton, Ohio.

1906. SHATTUCK, FREDERICK C., M.D., 135 Marlborough Street, Boston, Massachusetts.

1894. WARREN, J. COLLINS, M.D., 58 Beacon Street, Boston, Massachusetts.

ELECTED

1894. Weir, Robert F., M.D., 11 East Fifty-fourth Street, New York City, New York.

1892. Welch, William H., M.D., Johns Hopkins Hospital, Baltimore, Maryland.

Foreign

1890. Baccelli, Guido, Rome, Italy.

1908. Bannerman, W. B., M.D., General, I. M. S., 11 Strathearn Place, Edinburgh, Scotland.

1899. Fraser, Sir Thomas R., M.D., LL.D., F.R.C.P., F.R.S., 13 Drumsheigh-Gardens, Edinburgh, Scotland.

1893. von Jaksch, Rudolf, M.D., Prague, Bohemia.

1912. Lazarus, Paul, M.D., Hindersinstr. 2, Berlin, N. W., Germany.

1909. Macallum, Archibald B., M.A., M.B., Ph.D., Sc.D., LL.D., F.R.S., 59 St. George Street, Toronto, Canada.

1906. Myles, Sir Thomas, M.D., 33 Merion Square, W., Dublin, Ireland.

1898. Roddick, Thomas G., M.D., 80 Union Avenue, Montreal, Canada.

1908. Ross, Major Ronald, M.D., R.A., Liverpool School of Tropical Medicine, Liverpool, England.

1904. Waldeyer, Prof. Wilhelm, M.D., W. 62 Sutherstr. 35, Berlin, Germany.

CORRESPONDING MEMBERS

1880. Carrow, Flemming, M.D., Washington Arcade, Detroit, Michigan.
1885. Rendu, Jean, M.D., Lyons, France.
1915. McIntire, Charles, M.D., Easton, Pennsylvania.
1916. Estes, William Lawrence, M.D., South Bethlehem, Pa.
1916. Guitéras, John, M.D., Havana, Cuba.
1917. Miner, Charles H., M.D., Wilkes-Barre, Pa.
1917. Stearns, Cyrus L., M.D., Athens, Pa.

NECROLOGICAL LIST

FELLOWS

JOSEPH W. WARREN, M.D.,	December 20, 1916
G. HUDSON MAKUEN, M.D.,	February 21, 1917
JOHN K. MITCHELL, M.D.,	April 10, 1917
ARCHIBALD G. THOMSON, M.D.,	October 21, 1917

ASSOCIATE FELLOWS

DAVID W. CHEEVER, M.D.,	December 27, 1915
THEODOR KOCHER, M.D.,	July 27, 1917
THEDORA DE VALCOURT,	No date obtainable

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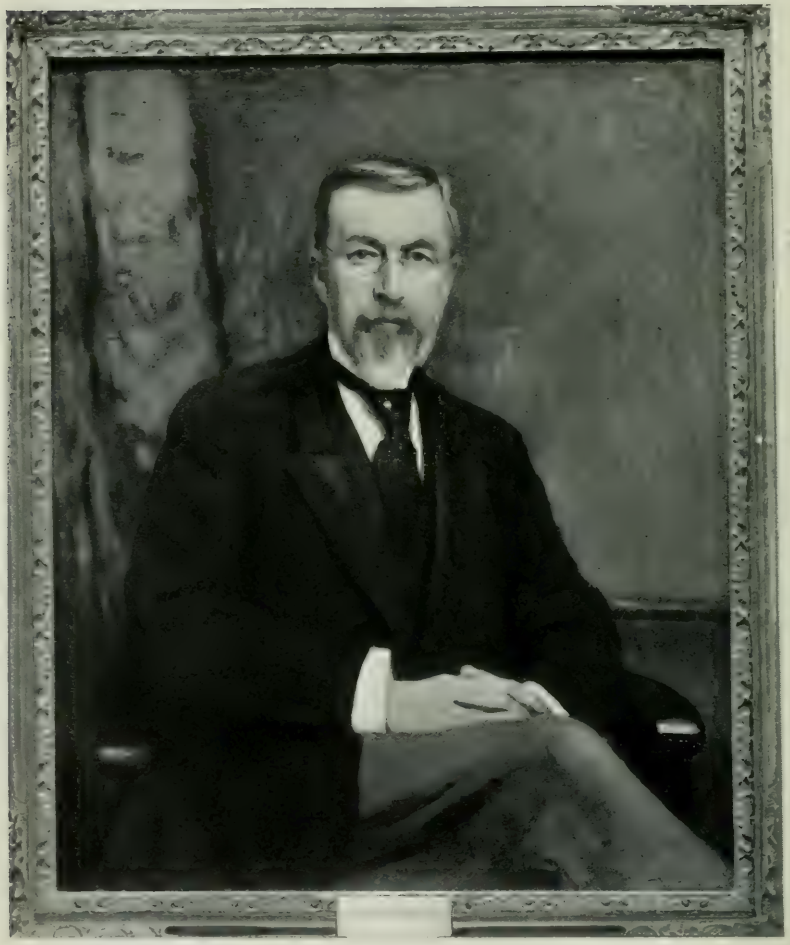

DR. JOHN H. PACKARD

PRESENTATION OF THE PORTRAIT OF DR. JOHN H. PACKARD[1]

I MUST apologize in not having prepared, as I had hoped to prepare, a sketch of the life of our beloved friend, Dr. Packard. All I shall say now I shall have to say without notes; yet I feel it is my duty to say something on this occasion, as it has been a time-honored custom at the presentation of a portrait of a deceased Fellow to speak of the part he played in this College, that the younger Fellows of the College may be familiar with his work, and that there may be a connecting link established between the present and the time when our deceased Fellow was active in the affairs of the College. All the portraits on these walls form such connecting links.

Dr. Packard came of an old family. His ancestors, the Hookers, were founders of Springfield, Massachusetts, and his father came to Philadelphia early in the history of this city. Dr. Packard was born in Philadelphia, and he had that advantage implied in the paradoxical expression, "If we could only select our progenitors, what a race of intellectual giants we would become!" He came of a family occupying a prominent position in society. He had that fortune which few men have of having been born a gentleman. He was a gentleman by birth and by education. Dr. Packard was born in 1832 and died in the year 1907. He was graduated from the Department of Arts of the University of Pennsylvania in 1850. To graduate from the Department of Arts at that time seemed to convey more than at the present.

[1] Presentation address by Dr. Richard H. Harte, on behalf of the donor, Dr. Francis R. Packard, May 2, 1917.

Now, young men go through a course in college and often seem to be inefficient. Only a short time ago this was demonstrated in a graduate who did not know that Henry VIII had six wives.

After graduating from the Department of Arts, Dr. Packard entered the Medical School of the University, from which he graduated in 1853. He was more than ordinarily occupied. After leaving the University he went to Paris, where he spent some time in the wards under Malgaigne and Nélaton and other such men. Returning to this country he entered the Pennsylvania Hospital as resident. He and Dr. Ashhurst were probably there at the same time. There were then two or three residents in the hospital; today, from fourteen to sixteen. After leaving the Pennsylvania Hospital as resident he entered the practice of medicine. Not long after that war clouds began to gather and we find him occupying the position of assistant surgeon in the army during the Civil War. He was assigned to the old Satterlee and Christian Streets Hospital. Before the war was over he was appointed surgeon to the Episcopal Hospital. Some of the soldiers were treated there, and probably that played some part in his subsequent appointment. In 1883 he was elected to the staff of the Pennsylvania Hospital. He was elected a Fellow to this college in 1885, and later became our Vice-President. For a number of years he acted as Secretary of the College and the old minute books show his beautiful handwriting. He was one of the charter members of the Obstetrical and the Pathological Societies, of the Academy of Surgery, and of the American Surgical Association.

Those who had not the fortune to know Dr. Packard missed much in life. It was a pleasure and a privilege to come in contact with him. I recall the old Philadelphia Medical Book Club, in which were a number of men occupying prominent positions in the medical world. There, as secretary, I was thrown into contact with some of the older members of the profession. Today this college buys books of the same dealer, H. K. Lucas, of England, as did the Medical Book Club. At the end of the year we had an auction sale. Dr. Allison, who lived out on the Main Line, was at

one time secretary, and always acted in the capacity of auctioneer. Dr. Lewis, Dr. Ashhurst, and Dr. Packard were always there, and many interesting and witty remarks were pitted against each other.

Dr. Packard had a wonderful ability with his pencil. He was of a distinctly artistic temperament, and when sitting at a desk any piece of paper which happened to be at hand was usually covered with some sketch, and many of those made at the Pennsylvania Hospital were very amusing. He possessed that wonderful gift of caricature, and it was developed in him to a marked degree. Had he not been devoted to medicine I have no doubt he would have occupied a position in literature or art second not even to Mr. Nast.

Almost my first interview with Dr. Packard was the occasion of speaking to him about a patient I had with cancer of the face. I was very young looking, and he probably thought I was a school boy. He was most considerate, examined the patient with great care, and treated me with all the consideration he could have shown to any man in the profession. Later on I had the privilege to serve with him as a colleague in the Pennsylvania Hospital. Our relations in the wards were most cordial, as such relations always are in that institution. He was interested in a form of surgery in which I was also interested at that time, and I was carrying on a series of operations particularly with certain forms of hernia. I met him one day and he said to me, "If my name were Kocher you would be only too glad too carry out the operation I am interested in rather than the one to which you are devoting your time."

Dr. Packard was very kind; I never knew him to say a harsh word to anyone; he was the personification of a gentleman.

He was stricken with disease, the result of infection, and for a number of years his time was unoccupied. He devoted much of his time to the Academy of Fine Arts, and was a very valuable member of the board. A great deal of the success of the Academy today is due to the untiring efforts and the artistic knowledge of Dr. Packard.

Dr. Packard after his illness frequently spoke to me as though he had nothing to live for; he had seemed disappointed. I remember saying to him: "Dr. Packard, if you feel that you have nothing to live for, just look back and see what you have got. I think you are more blessed than any man I know. Many men have gone through life and accomplished nothing. When you recall the love and comfort of your family, you realize that these things cannot be bought with money. These are the results of the care and devotion you have lavished upon your family." His son, our beloved Frederick Packard, who was so identified with this College, had he lived would have occupied a position second to none. As a young man he held a very prominent position. As we all know, he was stricken with an attack of typhoid fever; there was perforation, and he succumbed after operation. One of his sons occupies an honored position in finance; a third son is our honored secretary. The world is better for Dr. Packard having lived in it. That is more than can be said of many of us when we go out of it.

I take great pleasure tonight, Fellows of the College, in presenting to you, on behalf of his son, Dr. Francis R. Packard, his portrait, the work of Mr. Breckenridge the artist, and I think it represents Dr. Packard very much as we have been in the habit of seeing in life our beloved Vice-President. I look forward to seeing this portrait adorning the walls of the College and linking the future with the past as only portraits of this character can do.

MEMOIR OF EDWARD LOUIS DUER, M.D.[1]

By JOHN H. GIRVIN, M.D.

When the President of the College requested me to prepare a memoir of the late Dr. Edward Louis Duer, who was elected a Fellow in 1864, more than half a century ago, I deeply appreciated the honor but felt that one of his contemporaries could better have expressed his relation to his time and to this College; but I accepted the task with the hope that my shortcomings would be overlooked and because of my many years of association with Dr. Duer at the Presbyterian Hospital and my life-long admiration and friendship for him.

It is an easy task to record the important dates in a man's life; what he has accomplished and what honors have crowned his career; but it is a different matter to draw a pen picture and put into it that spirit and charm which make up the real man. Fortunately most of you have a personal recollection of Dr. Duer, even though it has been several years since he dropped his active work and left Philadelphia for a less active and quieter life. He could not have had it here, for the habit of a lifetime, to respond to the call whenever it came, was too strong to be easily overcome.

Edward Louis Duer was born January 19, 1836, in the little New Jersey village of Crosswicks, not far from Trenton, where his ancestors, who were on both sides of English descent, had lived for several generations and where some of the family still live. His early education was by private tutors until he entered Yale College and was graduated from there in the class of 1857,

[1]Read May 2, 1917.

just after attaining manhood. While at Yale he pursued the engineering course, and was a popular student and one trusted and loved by his friends and associates. His interest in his Alma Mater continued during his long life, and he at one time served as president of the Yale Alumni Association of Philadelphia.

Dr. Duer was the son of Dr. George S. Duer, and his interest early turned to medicine. After graduation from Yale he soon entered the medical school of the University of Pennsylvania, and was graduated from there in 1860. From this time until his death his all-absorbing interest was medicine. Very early in his profession this interest centered in obstetrics, and at the termination of his service as resident physician in the Philadelphia Hospital which followed his graduation, he was almost immediately elected obstetrician to that institution, which position he held for eighteen years, during which time he inaugurated the first obstetrical clinic established in this city. He later served in the obstetrical departments of the Polyclinic and Maternity Hospitals, and was instrumental in the organizing and founding of both of these institutions. During the Civil War he served as an acting assistant surgeon, and for a time did much operating.

In 1877, five years after its organization, he was elected gynecologist to the Presbyterian Hospital and served in that capacity until 1911 when he was retired from the active work and elected consulting gynecologist and at the same time was made chief of the newly organized obstetrical department. Here his many years of obstetric work and his deep interest in the Presbyterian Hospital were most useful. At this time he was also consulting obstetrician to the Maternity Hospital and Preston Retreat.

Dr. Duer may truly be said to have loved his profession and to have made it his whole interest. He never made the commercial side of his work its main object, but was repaid for his labors in part by the friendship of his patients and in part by the love for his work, and he reaped an abundant reward in this way, for he had a large practice, mostly among the better classes of society, and was looked upon as a friend in many of the houses of the wealthy and socially prominent in Philadelphia. But he also had

his reward among his professional associates in his election to many honorary positions. He was president of the Philadelphia Obstetrical Society from 1881 to 1883; some time president of the Association of "Blockley" ex-residents, and president of the Medical Club of Philadelphia and the Philadelphia Alumni Society of the medical department of the University of Pennsylvania and president of the A. M. P. O. medical fraternity. He was a member of the American Gynecological Society, and at one time its vice-president; of the American Medical Association, the County Medical Society, the Pathological Society, and beside these purely medical organizations he was president of the New Jersey Society of Pennsylvania and the Yale Alumni Association of Philadelphia, and a member of many of the social clubs of Philadelphia.

Dr. Duer was never a prolific writer and never felt the necessity to write a book, although he contributed an occasional article to the medical magazines. He was one of those practitioners of medicine whose daily life was so full and whose calls were so many and so insistent that he could devote little time to writing. Such a life leaves its mark more in the hearts of his contemporaries and his patients than it does upon the shelves of the library or the pages of a text-book; and, in fact, while Dr. Duer was for many years connected with active hospital work, it was not so much as a teacher but rather as a clinician of skill and practitioner of broad experience and sound judgment that he was known. His cheering greeting, his vitality and confidence, his friendly interest, and his broad humanity endeared him to his patients and to his colleagues alike. He was always ready to divert the mind of the nervous and suffering patient or the anxious and inquiring colleague by some anecdote or tale, and yet he did not lose interest in the case or minimize the symptoms. His ability was to cheer as well as to heal. His vitality and youth were far beyond his years in spite of numerous attacks of gout, which was his chief enemy.

In 1863 Dr. Duer married Miss Clara Naudain and had one son and one daughter, who survive him, but his wife died many years ago, and in 1907 he married Miss Louise Naudain Corbit, and a few years later retired to her home in Odessa, Delaware, where

he happily passed the last few years of his life with an occasional visit to some old patient or a word of advice, for he could not give up the old habit, and his mind was bright and active to the very last in spite of his fourscore years. His death occurred on September 6, 1916, from an ulceration of the stomach.

PRESENTATION TO THE COLLEGE OF THE RETRACTOR USED IN OPERATION UPON PRESIDENT CLEVELAND, THE SPECIMEN REMOVED AND THE DENTAL CASTS MADE[1]

By W. W. KEEN, M.D.

In the *Saturday Evening Post* of September 22, 1917, I have described in detail the financial, political and surgical conditions surrounding the operations upon President Cleveland by Dr. Joseph D. Bryant, of New York, and myself. The two operations done were the removal of the left upper jaw (except the floor of the orbit) for a sarcoma. It was, of course, essential that secrecy should attend the whole affair because of the very perilous condition that the country was in on account of the financial crisis then threatening our financial stability. This crisis was at its height in July, when we did the operation. Mr. Cleveland himself enjoined absolute secrecy, and therefore the operation was done in the cabin of Commodore Benedict's yacht "Oneida." During the evening of June 30, 1893, all of us were secretly taken from various wharves in New York to the "Oneida," which was lying off the Battery. The operation was done on July 1, while the yacht was proceeding at half-speed eastward in Long Island Sound. It was essential also that secrecy should follow as well as attend the operation. If it had become known that any serious operation had been done and that the Vice-President, a strong silver man, might possibly succeed to the Presidency the financial crisis would have become a riot. Mr. Cleveland had called a special session of Congress for August 7 to obtain the repeal of the silver clause of the Sherman Act. We therefore were obliged to devise means for

[1] Read October 3, 1917.

the removal of the left upper jaw in such a way that there would be *no external scar*. Had there been any visible scar, secrecy would have been impossible. That was accomplished more particularly by means of this cheek retractor. Until recently I have never seen in this country any instrument like it. You can see very easily that it would lift the cheek from the upper jaw to such a distance as to allow the operation to be done intra-orally and thus avoid any external scar. I bought the retractor of Luer, in Paris, in 1866. It has served me well in many operations of this character. It is with a great deal of pleasure that I present this to the College as a memento of this important operation.

Not only have I the pleasure of presenting this to the College, but also, through the courtesy of Dr. Kasson C. Gibson, of New York, the dentist who fitted the original denture shortly after the operation, I am able to present the fragments of tissue which we removed at the operation. The specimen is in this jar, and is given to the College on condition, as stated on the label, that it is not to be loaned or photographed for newspaper or other similar use. I have also the pleasure of presenting to the College, on behalf of Dr. Gibson, two photographs of two plaster casts of the jaw. The first shows the large cavity that was left immediately after the operation and the second one shows how much of this cavity had been filled up by Nature four years later. With these also Dr. Gibson presents to the College the laryngeal mirror used for reflecting light during the operation. All of these are given under the same prohibition of their being photographed or otherwise publicly reproduced.

THE ANNUAL ADDRESS OF THE PRESIDENT[1]

By RICHARD H. HARTE, M.D.

It has been a time-honored custom in this College for your President in his annual address to review the work of this body for the year just completed.

Before doing so I feel I must crave your indulgence for permitting my absence in the winter from a number of meetings and relegating my duties to your honorable Vice-President, Dr. Taylor. My excuse for my absence was the urgency of the call and the need of assistance incident to the terrible conflict which is at present rending Europe asunder. The American Ambulance in Paris, a hospital supported by a group of patriotic Americans, has depended almost entirely upon the efforts of the Pennsylvania Hospital and those interested to maintain its personnel and to carry on the active surgical work started so early in the war by Dr. Blake, of the American Committee. The success that has been attained by this institution for the care of the wounded and for the advancement of surgical knowledge is due to the splendid supervision of our own Fellow, Dr. Hutchinson, who has been the dominating influence in the hospital now for almost two years. The records and the experience that he will have at his disposal when the great conflict is ended will be such, I think, as have never emanated from any military hospital before in history. The work is truly American and represents the best surgical efforts of our country, and is regarded by those who are competent to judge as a monument to American energy, skill and efficiency. It was to assist in filling a gap that existed at the time in the personnel of the staff of the

[1] Read January 3, 1917.

American Ambulance Hospital in Paris that I deserted the post with which you have honored me.

The Scientific Business. The scientific business of the College for the year just completed has been maintained up to a very high standard. Too great credit cannot be given to the untiring efforts of your Committee on Scientific Business who have arranged the programs in June, which extend to the meeting in the following April. As our scientific meetings have been of considerable length, the Council (to obviate this) has recommended that the College hold three adjourned meetings in the year for the transaction of business, thus relieving the scientific meetings of a great deal of routine work.

A public lecture which taxed the seating capacity of Mitchell Hall was given by Doctors Lee and McCarthy, fully illustrated by lantern slides, dealing largely with the work of the American Ambulance in Paris and war activities on the French line.

The roll of the College for the year 1916 consists of 463 Fellows; 18 Associate Fellows, American; 12 foreign (making a total of 30); 5 Corresponding Members. Total, 498. Of the 463 Fellows, 424 reside in Philadelphia and its immediate vicinity; the remaining 30 are non-resident. The College has lost by death and resignation 11 Fellows and 3 Associate Fellows. It has added to its membership during the year by the election of 12 Fellows and 2 Corresponding Members.

Twenty papers have been read at the stated meetings of the College, and seven gentlemen not Fellows of the College have taken part. Seven of the papers were illustrated by lantern slides. Three Memoirs were read: one by Dr. James Tyson, of the late Dr. Morris Longstreth; one by Dr. Abbott, of the late Surgeon-General Dr. George M. Sternberg; and one by Dr. Holland, of the late Dr. William L. Rodman. It is with pain and sorrow that we are forced to look at our long list of Fellows who have been removed from their various fields of activity. They have left behind them an indelible imprint on the pages of medicine as a result of their labors in the cause of science and humanity.

Necrology. During the year we have lost by death:

Robert N. Willson, a graduate of the University of Pennsylvania in the class of 1897, elected a Fellow in 1902, died January 1, 1916, aged forty-three years. A student of great and untiring energy, deeply interested in sociological problems; a clinician of unusual ability; he left behind many friends in the medical wards of the Philadelphia General Hospital, where he was a devoted and ardent worker.

William L. Rodman, graduated from the Jefferson Medical College in the class of 1879, elected a Fellow in 1900, died March 8 of pneumonia. Dr. Rodman was a gentleman of charming personality; a skilled surgeon, a brilliant lecturer and a teacher of the highest order; leaving valuable contributions to the study of mammary tumors and gastric ulcer; he was also exceedingly active in laying plans for the foundation of a national board of medical examiners. His memoir has been read by Dr. Holland, and full comments made of the valuable services he rendered to the profession.

Emlen Physick, graduated from the University of Pennsylvania, class of 1878, elected a Fellow in 1909, died of cerebral hemorrhage March 21, aged fifty-seven years. Dr. Physick was a grandson of the celebrated Dr. Philip Sing Physick, often spoken of as the Nestor of American Surgery. Dr. Physick was never actively engaged in the practice of his profession, but was deeply interested in the humane treatment of animals. He possessed a kind and generous nature and was beloved by those who came in contact with him.

Charles Claxton, graduated from the University of Pennsylvania in the class of 1882; died of pneumonia at the age of fifty-seven years. Dr. Claxton was at one time a resident at the Episcopal Hospital. After leaving there he traveled extensively in India and the Orient, and upon returning to Philadelphia he practised in Germantown, where he had a large group of devoted and loyal patients.

Norton Downs, graduate of the Class of 1888 from the University of Pennsylvania, elected a Fellow in 1893. Died on April 5,

1916. Dr. Downs was actively interested in obstetrical practice in Germantown, where he had a great many admiring friends. He retired from active practice early in life and devoted himself to rural pursuits. He was also actively interested in the Philadelphia Zoölogical Society, where he was a Director for many years.

J. William White, born in 1850, graduated from the University of Pennsylvania in the class of 1871, elected a Fellow in 1878. An accomplished surgeon, an author of distinction, a teacher of unusual power, an extensive traveler, and a man of remarkable personality and force. The recipient of many academic honors, for thirty years a teacher in his Alma Mater, and later one of her trustees. We will leave to his biographer, Dr. Martin, to delineate the various activities which have made Dr. White's name so prominent in the world.

Edward L. Duer, graduated from the University of Pennsylvania, class of 1860, elected a Fellow in 1864. Dr. Duer died in Odessa, Delaware, in his eightieth year. He was a surgeon in the Civil War and afterward devoted himself to obstetrical practice. He was at one time obstetrician to the Philadelphia General Hospital, gynecologist to the Presbyterian and one of the founders of the Philadelphia Polyclinic. He enjoyed a large and lucrative practice, was loyal and devoted to his patients, thoughtful and considerate of his brother-practitioners, a true and steadfast friend. His record will be dealt with more fully by his biographer, Dr. Girvin.

Alexander Williams Biddle, a graduate of Jefferson Medical College in 1879, elected a Fellow in 1884, and died suddenly at his summer home in Islesboro, Maine, aged sixty-five years. Dr. Biddle was never actively engaged in professional work, but was a man of great charm, was thoughtful, considerate, and beloved and respected by all who knew him.

Alexander A. Uhle, a graduate of the University of Pennsylvania with the class of 1898; elected a Fellow in 1904; he died October 21, 1916, of cocain poisoning incident to a tonsilar operation. Dr. Uhle was actively interested in genito-urinary surgery; an indefatigable worker, a man of great skill and of a charming personality,

he was much loved and respected by all who were fortunate enough to know him.

David Braden Kyle, graduate of Jefferson Medical College in the class of 1891, elected a Fellow in 1897. He was professor of laryngology and rhinology at Jefferson Medical College, and the author of a standard book on diseases of the throat and nose which has passed through five editions. Dr. Kyle occupied the first rank in laryngology and was honored by being made President of the American Laryngological Association and the American Otological Association. He was chairman of the Committee on Otology and Laryngology of the College; an accomplished laryngologist and aurist; was earnest in his work, successful in results, giving so far as the College was concerned valuable attention to the development and improvement of the section which had honored him by making him chairman. He enjoyed a large and lucrative practice and won for himself many friends of distinction, who admired him for his kind, genial, and generous nature as well as his ability in his profession.

Victor Alexander Haden Horsley, elected an Associate Fellow in 1903, died of sunstroke in the line of duty in Mesopotamia in July, 1916, aged sixty years. Horsley has occupied such a prominent place in the surgical world that it seems fitting that more than a passing note should be made at this time of his marvelous activities. His career began with an unbroken line of academic successes; he has been the recipient of many degrees, the most important being that of Fellow of the Royal Society, in recognition of the work he did on myxedema, being early to recognize that this condition was dependent upon the absence of thyroid secretions, based on the material that he collected in Switzerland. As a result of experimentation on monkeys, he began early to sketch out a systematized work on brain surgery. As a cerebral anatomist and physiologist he was in the very first rank in experimental research.

A leader in thought and action, at the age of thirty he had gained for himself an extraordinary position because of his original work in various directions on the common ground of pathology and physiology. He did more than any other person to clear up the maze

and uncertainty in which intercranial and spinal tumors were lost in the 80's. His contributions to neurological surgery, and especially to operations on the Gasserian ganglion, were alone sufficient to establish for him a world-wide reputation. He devoted much time and energy to politics, being an advanced liberal and democrat. An ardent advocate of temperance, he based his deductions on scientific reasoning; he was also a strong believer in the cause of woman suffrage.

To have known Horsley and to have had an opportunity to watch him study and diagnose an obscure cerebral case was in itself an inspiration. The deductions obtained were not the composite finding of a number of specialists, but the result of his own investigations based upon an intimate knowledge of the use of the ophthalmoscope and the observation in the minutest detail of the skilled neurologist. His unfailing kindness and his generosity endeared him to all who came within the sphere of his influence. His untimely death can be attributed directly to his patriotism; he was endeavoring to relieve the sufferings of the men fighting in Mesopotamia, and there succumbed to the climatic conditions.

L. McLane Tiffany, elected an Associate Fellow in 1896, died at his country home, Mt. Custis, Accomac County, Virginia, in his seventy-second year. He was at one time professor of surgery in the University of Maryland, a consultant to Johns Hopkins and other hospitals in Baltimore; a distinguished ex-president of the Southern and the American Surgical Associations, and it was through the latter that he became acquainted and endeared to so many of the Fellows in Philadelphia. Dr. Tiffany was a surgeon of international reputation; his many valuable contributions to surgical literature would of themselves have conferred eminence; and his work in the treatment of compound fractures has left a decided mark in the advancement of surgery. He represented a link with the older generation of the profession which is now fast passing away.

Sir Thomas Lauder Brunton, M.D., F.R.S., elected an Associate Fellow in 1894, died on September 16. In early life he attained recognition as an experimental investigator in the action of drugs,

and with Sir Joseph Fayer carried on very extensive studies on snake venom. Probably the most important result which he obtained from his experimentation was the introduction of blood-tension lowering drugs into practical medicine. He was the author of an exhaustive treatise on *Therapeutics and Pharmacology*, and was a firm believer in the efficiency of drugs. He was honored by the Royal Society in being made a Fellow. He possessed many of the characteristics of the Scot, and was a dominating factor in every case with which he came in contact.

I wish also to speak at the loss that we, with the University of Pennsylvania, have sustained in the death of Mr. Eckley B. Coxe (September 20),„to whose generosity we are indebted for the property now known as the Sinkler Memorial Garden, and not only for this, but as a liberal donor to our building fund, which helped us materially in the erection of our present building. Mr. Coxe possessed a kind and generous spirit, was deeply interested in the advancement of all scientific undertakings, and it was through his interest and liberality that the University was able to carry on the excavations and research work in the East, which has added so much wealth to the collection of the University Museum of Archeology.

The Library. The College has received during the year some very valuable editions of books and collections of silver. A handsome silver centerpiece was presented by Dr. J. C. Wilson, a silver candelabra by Dr. Ashton and the gift of a silver punch-bowl and six cups from Dr. de Schweinitz. Lady Grace Revere Osler presented through your president, while he was at Oxford, a silver mug formerly the property of Prof. Samuel D. Gross, which had been presented to him by Dr. Robley Dunglison. A valuable and practical gift of six dozen pieces of table silver of the Georgian period was presented to the College for use in the dining-room.

According to the report of the chairman of the Library Committee, at present the total number of volumes in the library, including the bound volumes and 15,367 unbound reports and transactions, amount to 115,346; the number of unbound theses

and dissertations 8577, and the number of unbound pamphlets 92,789. Included in the above total there are 3479 volumes known as "reserves," consisting of second copies of some of the more important periodicals published, and 2993 volumes more or less incomplete. Duplicates are not included in the above total of 4968.

The following table shows the number of volumes in the Library:

General library.	Bound.	Incomplete and unbound.	Total.
General Library . . .	79,614	2,946	82,560
Lewis Library	13,596	44	13,640
S. D. Gross Library . .	3,559	3	3,562
Library of the Obstetrical Society of Philadelphia .	217	....	217
Making a total of			99,979

Received during the year from all sources, 3936 volumes, 13,070 pamphlets, and 18,608 numbers of various periodicals.

The total increase in the number of volumes for the year is 2451.

Photographs received of Fellows of the College, 29. Foreign, 1. Portraits under "Portraits Listed," 7577.

The individual donors for the year include 443, representing 892 distinct presentations.

The total number of Incunabula at the present time is 193, six volumes having been added during the year, in addition to a number of rare volumes purchased from the "Rare Book" fund. The library is as ever indebted to the generosity of Sir William Osler for the gift of some very interesting and rare books.

During the year the following additions have been made to our Incunabula.

INCUNABULA

(Total number of incunabula at this date, 193)

Abiosus, Joannes. Dialogus in astrologiæ defensionum. Venice, Franciscus Lapicida, 1494. [Hain 24.]

Very rare work, and the only work printed by Lapicida. This copy was bound by Rivière.

Fund for Rare Books.

Albucasis. Incipit liber servitoris. [Simple medical preparations.] Venetiis, Nicolaus Jenson, 1471. [Copinger 3450.]

Only a few copies known. Very valuable from a typographical point of view, being a dated Jenson work of 1471.

Fund for Rare Books.

Alchabitius. [Libellus isagogicus de planetarum conjunctionibus.] Venetiis, Johannes & Gregorius de Gregoriis, 1491. [Hain 618.]

An unusually interesting copy. The ordinary edition is described by Hain 618. This copy, however, has a number of pages printed in a type larger than that used in the bulk of the work; and the first line of b 3 belongs to some other medical book.

Fund for Rare Books.

Benedictus, A. De observatione in pestilentia. Venetiis, per Johannem et Gregorium de Gregoriis, 1493. [Hain 807.]

Fund for Rare Books.

Censorinus. [De die natali.] Bononiæ, Benedictus Hectoris, 1497. [Hain 4847.]

Fund for Rare Books.

de Thienis, Gaietanus. [Recollectæ super viii libb. physicorum Aristotelis.] [Tarvisium, Hessen, 1474.] [Hain 15496.]

Important and little-known work by the third printer in Treviso, who printed only two works.

Fund for Rare Books.

The number of visitors to the Library during 1916 was 5910 and the corresponding period for 1915 was 8270, a decrease of 2360. The number of Fellows of the College visiting the Library during 1915 was 3263 and during 1916, 1864, a decrease of 1399.

The Library has been kept open two evenings each week and the legal holidays during the same periods of time as the preceding year.

The number of books consulted in the Library in 1916 was 18,808; in 1915, 25,770; a decrease of 6962.

The number of books reported as consulted in the Library included only those on demand. Readers have access to the bound volumes kept in the reading-room and the Fellows have access to the book-stacks. There are therefore a great many volumes consulted of which no accurate record is kept.

The number of books taken out during 1916 was 4553 and 1915 4799, a decrease of 266.

12,791 unbound pamphlets and reprints have been subject-headed and arranged alphabetically by subjects and by authors under the subject. The work of making this important change in the arrangement of the unbound pamphlets and reprints is now about completed and the binding under subjects will be commenced early during the coming year.

The figures in the report compared with the previous year show a decrease in the number of visitors of 2360 and the number of visits by Fellows, 1399 and the number of books consulted 6962, and the number of books taken out 266.

On the other hand the study rooms show a decided increase in the number of volumes called for and retained in these rooms for reference. The average has been 203 volumes, an average increase of 28 over the previous year.

Naturally the question arises why there should be a diminution in the number of visitors to the Library, and also the number of books consulted and removed by the Fellows. The effect of the European war and the difficulty of obtaining regularly our periodicals and new books has been gradually recognized by the medical public, and consequently fewer visitors have consulted the library, knowing that it is lacking and will be lacking in fresh literary material for such time as the war lasts. An evidence of this is emphasized by the fact that no periodicals in the German language have been received since March, 1916; but our agents state that most of the journals are being published and a copy of each issue is held for each name on the subscription list and they all will be delivered as soon as the necessary arrangements can be completed.

We are confident that since the beginning of the yeat 1914 quite a number of journals, as well as other serial publications in the French, German and Italian languages, have ceased publication. How many and what they are will not be known until peaceable conditions have been restored and time allowed for readjustment.

In regard to new books, there has been a considerable increase

in the number of new publications received (160). It was stated in last year's report that when compared with 1913 there was a loss of about 90 per cent. of books published in the French language, about 69 per cent. in the German, and about 34 per cent. in the publications of Great Britain. In making the same comparisons between the years 1913 and 1916, we find a loss of 81 per cent. in French, 84 per cent. in German, and a gain of 7 per cent. in English publications. These figures, therefore, show a gain of 9 per cent. in the French; a loss of 19 per cent. of the German publications, and an increase of 41 per cent. of the publications of Great Britain in the year 1915.

Your Library Committee wishes to comment in regard to the storage of our books and periodicals in open stacks. The stacks for this Library were built in the most improved manner at the time of their erection in 1908, being fireproof and according to the most modern construction, a window opposite each aisle in the stacks and a window at the end of the main corridor on each floor. The windows are of wired glass set in a steel frame with an automatic low-fused steel fire curtain for each window. Light and air, according to the opinions of the time, were considered absolutely necessary for the care and preservation of books. It has been found impossible to fit steel-cased windows sufficiently tight to prevent the entrance of more or less dirt, according to the location, and a most serious problem in the use of open stacks is to prevent damage to books from the constant handling in the attempt to keep them sufficiently free from dust to be ready when called for.

This building, unfortunately, is so situated that the dust which permeates every closed window, including the stacks, contains a large percentage of soot, a form of dust which cannot be entirely removed with a high-power vacuum cleaner, but only by wiping with cloths, resulting in a smudge which shows more or less on the tops of the books. A comparison, if it could be made at present, would show a marked difference in the general condition of the books that were brought to this building after twenty-five years in the locked cases at Thirteenth and Locust Streets, and after nine years in their present location in our open stacks. Modern

lighting, electricity, forced ventilation, and forced air with exhaust in stacks, built without windows or skylights, in the opinion of the committee, is the only feasible plan for the proper care of a large collection of valuable books open and ready for use at all times.

It would seem urgently necessary that the present system of lighting and ventilation should be materially changed by substitution of brick-and-mortar sealed windows, and all means of entrance of extraneous air, dust and dirt, and that the lighting and ventilation should be maintained by artificial means. If this, in the opinion of your committee, is not carried out it would seem that it is only a question of time before complete deterioration of the books in our stacks will take place. For this it will take a considerable expenditure of money, but under the circumstances we can see no other alternative but to vote to the Library Committee the necessary funds to bring about this very important change and alteration for the permanent care of our books.

Here I wish to impress on you the debt of gratitude that you owe to your Honorable Librarian and the Library Committee for their efforts in conducting the arduous and exacting duties relative to maintaining the Library in its high state of efficiency which it has enjoyed during the past year. And also to express to Mr. Fisher and Miss Zelner our appreciation of the valuable and faithful services rendered by them to the various committees whom they have assisted in carrying on the work of the College.

Your president is pleased to announce that Mr. Clement B. Newbold has again added to the debt of gratitude which we already owe him by founding the Mary Scott Newbold Lectureship Fund, amounting to six hundred dollars annually, for the purpose of enabling us to obtain distinguished lecturers to address the College on subjects related to medicine or the allied sciences.

The Publication Committee issued the usual volume of *Transactions* of the College, consisting of 499 pages, which is fully up to the standard of our previous publications, and has been very favorably received. It is with the hope that our *Transactions* may be

made even more valuable, by combining in them all or part of the scientific papers which have been delivered during the year, including the Mütter lectures and the formal papers presented by the various sections of the College. We feel that this Committee, with their painstaking energy as displayed in time past, will assure us of added value to our publications in the future.

The report of the Committee on the Mütter Museum is most satisfactory. Dr. Nelson M. Percy, professor in the Medical School of the University of Illinois, delivered a very interesting and instructive lecture to an appreciative audience on "Pernicious Anemia, with Special Reference to its Surgical Management," based on a great number of splenectomies, illustrated by lantern slides and tables.

The Hall Committee have administered their responsible duties with efficiency and economy. There have been no decided changes or alterations for the year just past. Carrying out the wishes of Dr. S. Weir Mitchell, a small dining-room is being fitted up in the rear of the office of the Directory for Nurses, where distinguished visitors and speakers for the evening can be entertained prior to the meeting of the College.

The Directory for Nurses. The Directory for Nurses has had one of its most active years, having furnished to the Fellows and to the public almost 3000 nurses, an increase of nearly 800 nurses over the previous year. This in itself is an evidence of the respect and confidence with which this Department is regarded, and reflects great credit on the committee who have so efficiently administered this important activity, which has assisted materially the income of the College.

Finances. The Finance Committee, of which our honorable treasurer is an active member, has made a most elaborate report to the College on its receipts and expenditures. The condition of our properties has been systematically examined, necessary

changes made in insurance, and the financial interests of the College closely watched in every respect. Our securities, now in the custody of the Pennsylvania Company for Insurances on Lives and the Granting of Annuities, are examined regularly by the Finance Committee and found to be intact. All of the various accounts of the College have been audited by a public accountant and correspond to the statement presented by the Treasurer and the various committees.

The bequest from the Duhring estate is now operative and will augment very materially our appropriation for maintaining the expenses of the Library and at the same time increase its usefulness. It should enable us to set aside from year to year a large proportion of our income to Capital Account, and thus guard against financial difficulties which might arise if the city changes its present method of dealing with properties occupied by ecclesiastical, charitable and educational institutions, or if our tenant at Thirteenth and Locust Streets should fail to renew the lease on the property it now holds.

Without going into details with regard to our securities, I would state that our real estate values are approximately $581,091; securities, $432,460, and cash uninvested, $31,304; total, $1.044,865. This latter amount consists of small unexpended balances from various funds of the College that it is difficult to keep invested up to their full amount. The Treasurer's report has given full details.

It is always a dangerous procedure for an institution to advertise its resources, as nothing is so disastrous as to impress upon the charitably disposed public one's wealth by the indiscriminate publishing of lists of investment. I would suggest that a copy of the balance sheet and a list of the securities be kept in the Treasurer's office with instructions to the bookkeeper to furnish such information to any of the Fellows who may be desirous of learning more about our finances and their investments. We feel that no reports of any kind whatsoever should emanate from the College, its officers or committees, which have not had the authorization of the Council and has been formally passed by the College.

Fellowship. We pass now to consider some of the policies and activities of the College which have been a fruitful source of discussion for a long time. Strong arguments have been advanced advocating the establishment of a junior fellowship, from which Fellows shall be selected from time to time, this membership to possess practically all the rights and privileges with some slight restrictions in government, based on a much-reduced annual contribution. It is urged that by this method the annual income will be increased, that the Fellows will have a much more intimate acquaintance with prospective candidates for Fellowship, and in that way the fiber of the College will be enormously strengthened.

Others advocate increasing the Fellowship by lowering our standards and admitting practically every candidate except for some very definite ethical reasons. In that way it is urged that more deserving young men can have the use of the Library and the privileges of the College, and in return our scientific reports and meetings will be richer in material and the body politic of medicine will be enormously strengthened by the proposed changes.

My answer to the proposal to enlarge the College by this means is: We feel that the history of the College and its traditions, after a period of one hundred and thirty years, would never have attained the enviable position which it now occupies had looser methods been pursued in its management. Its requirements for Fellowship can hardly be too high and its doors for admission be too closely guarded. The College was designed by its founders to be and should remain a thoroughly representative body, and its seats should be occupied by those who, after years of professional toil or by literary labors or original research, have achieved distinction in one or several of the departments of medicine. We may be charged with an attempt to foster an aristocracy in medicine. The charge would be a rightful one, and there should be such an aristocracy; not one in an offensive sense, however, nor one based on wealth, family or social distinction, but on merit and merit alone, and accessible to the humblest as to the most favored member of the profession.

The College today occupies a unique position in the medical

world, with its age, ancestry, traditions and its rich possessions; but these will lapse into uselessness if it fails to maintain a live, active, progressive policy, with a management that is always alert and that takes an active part in the various problems with which we are daily being confronted—problems relating to the lessening and prevention of disease, improvement of health and sanitation and the standardization of our medical schools and hospital work and management. It would seem wise that a Committee on Sociology be appointed, whose duty it shall be to formulate and report plans for dealing with many of these hospital problems, and encourage presentation of papers and discussions on the most important branch which deals so intimately with our hospital patients.

Another necessary activity for the College would be the establishment of a Committee on Industrial Hygiene, for the formation of an intelligent scheme for preventing many of the diseases directly due to defective labor conditions incident to light, heat and proper ventilation of many of our industrial institutions. We should be the first to suggest improvement on these lines rather than allow a group of laymen in the Bureau of Health to suggest legislation to correct many of these abuses.

I may be pardoned for calling attention to some misunderstanding which may exist on the part of some of the Fellows with regard to the election of candidates for Fellowship. Persons are often submitted for honors in the College who have contributed little or nothing toward the advancement of medicine in any form, by Fellows who have been requested to present a name, or again as a compliment for being called in consultation by the prospective candidate; and when the necessary commendatory letters are sent to the Council many of them are of such character as to chill the enthusiasm of the most ardent advocates for increasing the membership, as it is plainly written between the lines that the candidate is lacking some of the requirements essential to Fellowship. This lack of proper consideration works harm three ways: (1) the feelings of the candidate are wounded; (2) the proposer feels that he has not had proper consideration by the Council, and (3) the Council is resentful that they are forced to assume

an unnecessary responsibility in rejecting a candidate who should never have been proposed.

This College must maintain an isolated position so far as numbers are concerned. It was never designed from its earliest inception to be a large popular body of medical men. We have other organizations which meet these demands, so that no person of any medical activity should suffer for one moment for an opportunity to find an outlet to exploit his special line of thought through some of the many channels of medical activity.

The College with its inheritance and traditions has assumed a great responsibility and has been carried along by a carefully selected group of men whose responsibilities have been gradually increasing. It is now in the nature of a trust with large funds to manage, new activities to develop, new lectureships to be founded to aid in special research of all kinds which will tend to the prevention of disease and of human suffering, and to the betterment and enlightment of the people of this Commonwealth.

So are your responsibilities increasing and growing from year to year, and I know they will be met in the spirit of Rush, Redman, Shippen, Kuhn, Hutchinson, and later, Da Costa, Mitchell, Agnew, Ashhurst and others, who truly had the interest of this great institution foremost in their hearts.

Let us visualize and think academically, so that as time rolls on we may possess a greater and more valuable library, a museum unique in its collections, lecture courses selected from the best sources that the world can produce in our respective lines of activities, and that our memorial garden to our beloved Sinkler may be the resting-place of a great laboratory founded and supported by philanthropic citizens who have confidence in our honorable body and its management and are willing that an opportunity shall be given to young investigators to work out and develop many of the problems which confront us today.

Our inheritance has been great; see to it that its treasures are not dissipated, but that we guard it and add to it and make ourselves worthy of the great trust that has been conferred upon us. This is my earnest wish.

THE CURE OF PROLAPSE OF THE UTERUS.[1]

By JOHN A. McGLINN, M.S., M.D.

The diversity of opinions expressed in the writings of the modern authorities in regard to etiology and treatment of prolapse of the uterus led to a search of the older literature to see if a period could be found in which there was a unanimity of thought on this subject. No such period was found; opinions were as diversified and debate as acrimonious a hundred years ago as they are today. In Dewees's *Diseases of Females*, published in 1837, we find a corroboration of this statement. At that period the profession was at loggerheads as to the value of conservative treatment as instanced by the use of the pessary, astringent douches, astringent applications to the vagina, and the closure of the vagina by adhesions from the use of caustics on the one hand and operative procedures on the other. Those who opposed the use of pessaries argued that the patients were not cured, that the conditions were made worse, as the constant pressure of the pessary caused ulceration, and eventually cancer and what seemed an unanswerable argument, that the pessaries caused so much pain that a woman would rather have her prolapse than a pessary. The operation proposed consisted in a denudation of the vulva, with suture of the two sides together, so that the opening into the vagina was practically closed. If the operation proved successful then the patient was cured to the extent that the uterus could no longer project from the vagina. Dewees, an ardent advocate of the conservative treatment, gives in detail the method of treatment and recites the objections made against it. He then states:

[1] Read January 3, 1917.

"So that my readers can form their own and unbiased opinion of the value of these two procedures, I will use Dr. F.'s own words in the description of this method." He then quotes Dr. Frick's description of the operation just outlined, and closes the chapter in this manner: "This horrible, severe, and ill-described operation is seriously proposed by Dr. F. as a substitute for the simple, successful and easily managed pessary."

Diversity of opinion and acrimony in debate are not the only things common to the modern and older writers. Many of the views heralded as new were known years ago. "The ancients doubted the possibility of the uterus being entirely prolapsed on account of the strong support given by its ligaments. Now we scarcely attribute any retaining or holding power to the uterine ligaments. By experiments on the dead body, Professor Burns found that more resistance was afforded to procidentia by the connection of the uterus and vagina to the neighboring parts than by the agency of the ligaments; for although he cut the ligaments he could not, without much force, make the uterus protrude. A debility and relaxation of the levator ani and perineal muscles, but particularly an extension and slacking of the pelvic fascia, in its connection with the uterus and vagina are in a great measure essential to the production of the prolapsus." This might well have been written by the most modern advocate of the newer pelvic anatomy, but unfortunately for their priority in this field it is a quotation from Ashwell's *Diseases of Females*, published in 1845.

It may be of interest to review briefly the literature of this subject showing the views held at different periods. Time will not permit a complete review, so I have divided the subject into ten-year periods beginning with 1880. Apparently little progress was made in the treatment of prolapse from 1838 to 1880. Except for operations to repair the lacerated cervix and operations on the anterior wall of the vagina introduced by Marion Sims the treatment was practically the same. In Byford's book, published in 1881, are a number of illustrations of the most marvelous and deadly-looking pessaries. He also discusses fully the pessary

treatment, and expresses himself as favorable to their use. He also states: "An efficient use of astringents would appear in some cases of extreme prolapsus to be sufficient to effect a cure." In regard to surgery he remarks: "Surgeons have generally, in their operation, addressed themselves to but one item in the case. One party operates on the perineum, restoring or lengthening it, more or less completely, to close up the vaginal orifice, while another party lessens the diameter of the vagina itself and condensing its walls into cicatricial or undistensible tissue. This latter was accomplished by the Sims operation or purse-string sutures without denudation."

T. Gaillard Thomas[1] records his method of treatment in a clinical lecture on a case of prolapse complicated by laceration of the cervix. The cervix was first repaired using silver wire. He proceeds: "The second step in the case will be the taking of a 'gore,' so to speak, in the anterior wall of the vagina by the operation known as elytrorrhaphy, and then the final operation will consist in the restoration of the destroyed perineum after which I think the case can be discharged perfectly cured." He also records a second case[2] treated in the like manner. It is interesting to note that in the fifteen communications found in the *Index* for 1880, two dealt with urinary calculi as a complication of prolapse. The majority of the authors held that lacerations of the perineum was the most important etiological factor. W. V. Jackson,[3] however, makes this observation: "I have never seen a case caused by a ruptured perineum nor have I met with a case cured by sewing up such a laceration."

James P. Boyd[4] discussed the causes and treatment of prolapse. He noted that the condition at times appears in virgins. He gave as causes falls, torn perineum, and weight of uterus. His treatment consisted of pessaries, elytrorrhaphy, and narrowing of the vaginal orifice by extensive denudation and suture.

From the excerpts read it will be seen that the surgeons of 1880 and 1881 had little concept of the pathological anatomy of the condition and little understanding of its rational treatment.

Thomas was in advance of his confrères as an operating surgeon.

He failed, though, to understand the anatomical injuries of lacerated perineum, cystocele, and prolapse. It seems odd that the surgeons of that period did not have a clearer understanding of the anatomical relationship of the bladder to the uterus and vagina. Vesicovaginal fistulæ were more common then than now, as were also vesical calculi and operations frequent for the cure of these two conditions.

Ten years shows a marked advance in the treatment of prolapse, and we find the surgeons in 1890 making use of the ligamentary supports of the uterus in attempts to effect a cure.

Smyley[5] said: "There are two types of cases, those due to relaxation of the pelvic peritoneum (meaning ligaments) and those due to relaxed and torn perineums." In the former he advised the use of the pessary and in the latter operation on the perineum. He advised Hegar's operation in old women and Martin's operation in women still in the child-bearing period. He reports a case of failure after a Hegar operation which was cured by an Alexander operation. He spoke of the difficulty of finding the ligaments in the inguinal canal, and reports that he practised on the cadaver before attempting the operation on the patient.

The use of the ligamentary supports was not in general use, however. B. C. Hirst[6] reported a case of complete prolapse in a girl, aged seventeen years. He cured the condition by performing a complete anterior colporrhaphy with sunken catgut sutures and by doing a posterior colporrhaphy somewhat after the method of Emmet.

That there was diversity of opinions at this period is shown in an article by I. B. Will.[7] He spoke of the chaotic condition of the subject both from the stand-points of cause and cure. He said "The theories advanced have been well-nigh innumerable, and the treatment advanced ranging all the way from that of a Virginia physician, who hung his negro patients head downward and poured the vagina full of a decoction of tan bark up to the most expensive silver and gold-plated utero-abdominal supports of modern times, on the one hand, and the narrowing of the vagina by plastic operations to the shortening of the round ligaments on the other." He

also spoke of the diversity of opinion on the part of the faculty of the New York Polyclinic Medical School.

The treatment by pelvic massage after the method of Thure Brandt, of Stockholm, was also in vogue at this period. The treatment was referred to by Alfred J. Smith.[8] The technic of this treatment consists in:

1. Lifting the uterus.
2. Massage of the uterus and its ligaments.
3. Forced separation and forced closure of the knees.
4. In tapotement of the lumbar and sacral vertebra.

The treatment of Thure Brandt has been recently recommended by Boldt, of New York.

In 1900 we find a still further advance in the treatment of prolapse. Watkins[9] discussed methods of treatment in vogue at this time. He considered them under the following:

1. Plastic vaginal operations.
2. Plastic vaginal operations combined with abdominal suspension.
3. Hysterectomy.

He then describes his method of operating, which was essentially a vaginal fixation of the uterus. Watkins has eventually developed this operation into one of the most important contributions on the subject of prolapse.

The first vaginal fixation was done by Schucking[10] in 1888. He performed the operation without freeing the bladder from the uterus. The bladder was frequently injured and his work received little notice. Sanger,[11] in 1888, also described vaginal fixation of the uterus. The operation was also described by Mackenrodt[12] in 1892, Dührssen[13] in the same year, and by Kuster[14] in 1894. Vaginal suspension was proposed by Vineberg[15] in 1896 and also by Wertheim[16] in the same year. These prior operations had to do with the correction of retrodisplacement of the uterus, and Watkins was first to make use of the principle for the cure of prolapse. With the development of the method to the present interposition operation are associated the names of Freud, Dührssen, Schauta, and Wertheim.

Gynecologists were not all in accord with Watkins; in fact, it is only during the past few years that his operation has received the attention it deserves.

John B. Deaver[17] said: "Three indications are to be met with, as a rule; the vaginal canal and vulva outlet must be resorted to their normal condition, the enlarged or subinvoluted uterus corrected and the uterine support applied from above." He favored ventral fixation, as sufficient support could not be obtained from the ligaments, and advised against vaginal hysterectomy.

Smith,[18] however, advised vaginal hysterectomy followed by plastic work for prolapse in elderly women.

Werder[19] spoke against hysterectomy. He operated as follows:

1. Curettement of the uterus.
2. Amputation of the cervix.
3. Anterior colporrhaphy.
4. Ventral fixation of the uterus.
5. Colporrhaphy.

E. E. Montgomery,[20] in discussing Werder's paper, suggested shortening of the uterosacral ligaments.

Noble[21] thought the most important part of the operation for the cure of prolapse was the restoration of the perineum.

Fritsch[22] proposed a unique operation. He anteverted the uterus through an anterior vaginal section, brought the fundus down into the vagina, and sutured the body of the uterus both to the anterior and posterior vaginal walls. The uterus became a permanent pessary in the vagina.

Here, again in this period, we see the diversity of opinion as to merthods of cure. Marked advance, however, in certain aspects of the cure were made; the realization of the importance of the cystocele and rational methods for its cure proposed by Watkins[9] and Hadra[23] being probably the most important. The realization of the importance of the pelvic fascia as a support of the uterus and the suggestion of Montgomery for the utilization of the uterosacral ligaments were also noteworthy developments. All the radical operations proposed at this period for the cure of prolapse

rendered subsequent pregnancy dangerous, and sterilization had to be performed in the child-bearing woman.

The literature on this subject from 1900 to the present time is so voluminous that it is practically impossible to review it. Probably the most important papers are those dealing with the anatomy of the pelvis. Of these may be mentioned the description of the ligamentum transversus coli by Mackenrodt, papers by Jellet,[24] [25] Tweedy,[26] Keyes,[27] Williams,[28] Keyes,[29] and Fitzgibbon.[30] Many communications have been presented dealing with the operative cure of prolapse. Of the most important are the various papers of Goffe, dealing with suspension of the bladder as a cure for cystocele and his operation of vaginal shortening of the round ligaments and also vaginal hysterectomy combined with his operation of bladder suspension for the cure of prolapse. Also important were those of Alexandroff[31] and Tweedy[26] dealing with Mackenrodt's ligament for the cure of prolapse; of Jellet,[24] [25] on the shortening of the uterosacral ligaments; the perfection of the interposition operation by Watkins and other authors; ventral fixation by Harris, Murphy, Baldy, and Korcher, and the Mayo interposition of the broad ligaments.

In spite of the immense amount of careful work done on the anatomy of the pelvis in relation to uterine prolapse, the casual reader is left in a quandry on account of the many diversified opinions as to the value of the supportive power of the various pelvic tissues. For instance, some authors hold that the pelvic floor is all important, others that it gives absolutely no support; others that the uterosacral ligaments are most important, others that they are of no importance; others that the endopelvic fascia is all important, others that it is of no importance; still others that Mackenrodt's ligament is the true support, others that it plays no part in the support; others that the round ligaments have an important function, others that they are useless, and so on *ad infinitum*. The same is true of operative procedures. There has never been in the entire history of uterine prolapse such a diversity of opinion as to etiology and treatment as at the present time.

Much of the confusion results from the idealistic attempts to reach perfection. Some authors consider uterine prolapse a hernia and then fail to apply the principles of repair of hernia in other parts of the body. Others dilate on the anatomy of the pelvis and discuss altered anatomical relations, and then attempt to restore normal anatomical conditions. This cannot be done; there never has or probably never will be unless man is given the power of recreation, an operation that will restore either a lacerated perineum or a displaced uterus by restoration of normal anatomy. The utilization of anatomical supports, yes, but not restoration of normal anatomy. As a matter of fact, many of the operations based on the so-called restoration of the normal anatomy depend for their success by distortion of the normal anatomical supports. There is no reason why in some cases even that adventitious supports should not be used to cure prolapse if success can be obtained. No one hesitates to restore a displaced kidney, stomach, colon, or liver by makeshift supports, and we hear nothing of restoring anatomical supports to these organs. We are satisfied if the means used hold the organs in place and cure the principal symptoms and produce no troublesome new symptoms. Why not apply the same principles to the cure or prolapse of the uterus.

Prolapse of the uterus is an abnormal condition, and in that sense a disease, and must be treated as conservatively or as ruthlessly as any other diseased organs as the nature of the individual case demands. As a matter of fact, we now have various ways of treating these cases successfully. No one method can be applied to every case, and while we can understand the enthusiasm of the promoter of an operation for this method, it is folly to attempt it.

In treating prolapse of the uterus we must understand the problems to be met in the individual case. What are the conditions which confront us?

1. In all cases of complete prolapse—cystocele—rectocele and prolapse of the uterus. Usually other complications are present, such as endometritis, laceration of the cervix, hypertrophy of the cervix, enlargement or atrophy of the uterus, ulceration of the cervix, and ulceration of the vaginal mucous membrane.

2. Is the prolapse in a multiparous or nulliparous woman?
3. Is the prolapse in a woman before or after the menopause?
4. What is the operative resistance in the patient?

Let us discuss conditions 2 and 3 first.

On general principles no operation should be performed on the nulliparous woman in early life that would interfere with or complicate pregnancy or labor. On the other hand, conditions might be such that no such method would suffice to effect a cure. Under such circumstances we would be justified in performing an operation to effect a cure and sacrificing her child-bearing function. The same question arises in the case of the multiparous woman in the child-bearing period, though the loss of function would likely not entail as great a sacrifice on the part of the woman.

This would rule out interposition operations, hysterectomy, all fixation operations both vaginal and abdominal unless artificial sterilization was performed at the same time. When it is decided to maintain child-bearing function a choice can be made from the following procedures: Replacement of the bladder by the Goffe method, restoration of the perineum combined with vaginal operations of the round ligaments by the method of Goffe, Vinberg, Wertheim, etc., or abdominal shortening of the round ligaments by any of the many methods of ventral suspension; or the vaginal or abdominal shortening of the uterosacral ligaments or the operation on the ligaments of Mackenrodt after the technic of Alexandroff and Tweedy. If circumstances are present that these operations would not effect a cure we can then resort to the interposition operation of Watkins, the Mayo operation, Goffe's operation No. 2, vaginal fixation, or abdominal fixation after the methods of Harris, Murphy, or Baldy, etc., combined with the necessary plastic work and artificial sterilization. When sterilization is necessary and the uterus is not removed, both Fallopian tubes should be taken out in their entirety. I cannot see what is to be gained by removing a wedge from the cornua of the uterus, cutting out a portion of the tube and burying the end that is left between the layers of the broad ligament except to complicate the operation.

Women before the menopause present, in addition to that of child-bearing, the question of drainage of menstrual and other uterine discharges. In the still menstruating woman no operation should be performed that will interfere with the drainage of the uterus. This rules out to a great extent the interposition operation but leaves available all the other procedures subject to the considerations discussed in relation to child-bearing. In the woman after the menopause none of these restrictions have to be considered and leaves available the operation best suited to the individual case.

Complications found associated with prolapse. Of these the most important is cystocele. Procedures for the cure of the cystocele are just as important as the cure of the prolapse itself. Simple denudation of the anterior vaginal wall is not sufficient to cure cystocele. The interposition operation of Mayo and Watkins in properly selected cases will almost invariably cure the cystocele, while at the same time curing the prolapse. The Goffe operation of suspension of the bladder at a higher level on the uterus or united broad ligaments, with anterior colporrhaphy, should form an integral part of all other operative procedures.

Rectocele. An efficient operation for the restoration of the perineum should be performed. Personally, I favor a flap-splitting operation with suture of the levator ani muscles and fascia in the midline between the vagina and the rectum with elevation of the rectum after the method of Ward. A well-performed Emmet or Hirst operation will be just as efficient.

Lacerations of the Cervix. The cervix if lacerated should be repaired or amputated, depending on local conditions present if the uterus is not to be removed.

Endometritis is present in nearly all cases except in those occurring in women after the menopause. When present the uterus should be curetted or else swabbed out with full strength tincture of iodin.

Ulcerations of the Cervix and Vagina. Unless amputation of the cervix or hysterectomy is to be performed, ulcers of the

cervix should be treated and cured before resorting to any operative procedure for the cure of the prolapse. Ulcers of the cervix in women near and after the menopause may be a serious menace as to cancer, and hysterectomy is advisable in women at these periods when the ulcers fail to heal promptly under appropriate treatment. A recent experience of my assistant, Dr. Morrison, has led me to the belief that all cases of indolent ulcer of the cervix complicating prolapse should be examined microscopically before resorting to any operation which does not remove the uterus. He performed a Mayo operation on a woman in the early forties, an apparently benign ulcer of the cervix was present. Microscopic examination of the specimen showed cancer at the site of ulceration.

When the vagina is ulcerated the ulcers should be cured before operating unless they are so situated that the vaginal denudation will remove them. Hypertrophy of the cervix should be treated by amputation.

Enlargement of the uterus may influence the type of operation to be selected. If enlargement of the uterus be present it should be treated either by complete vaginal hysterectomy, supravaginal hysterectomy by the vaginal or abdominal routes, or by removing a wedge-shaped piece from the body of the uterus. When enlargement of the uterus complicates the prolapse the following operations are available: Vaginal hysterectomy followed by the technic of Goffe or Mayo, Watkins interposition operation with reduction of size of the uterus by removing a wedge-shaped piece of the body, supravaginal hysterectomy followed by the Baldy technic of ventral fixation of the cervical stump, Murphy's method of ventral fixation after removing a wedge from the body of the uterus.

Atrophy of Uterus. When the uterus is atrophic none of the operations upon the various ligaments are likely to prove successful. The Watkins interposition operation is also contraindicated when the uterus is small. Fixation of the uterus also frequently fails under these circumstances. The best results are

probably obtained by the Mayo or Goffe operation. Conditions are such, however, at times, that nothing short of obliteration of the vagina will affect a cure.

What is the operative resistance of the patient? The choice of operative procedure will depend upon the condition of the patient. In general, patients with prolapse have lowered tissue tone and are not particularly good surgical risks. On account of the extensive plastic work necessary, operations for the cure of prolapse take a considerable time to perform. Many of the patients are advanced in years and the use of ether and chloroform entail serious dangers to the operations. In the majority of our cases we operate under scopolamin-morphin, narcosis alone or with a minimum amount of ether or chloroform, or else under spinal anesthesia.

Vaginal operations, as a rule, are safer than abdominal ones. Some cases, however, are such poor surgical risks that the vaginal operations necessary to effect a cure are contra-indicated on account of the length of time it takes to perform them. In these cases we have resorted to simply doing a high fixation of the uterus under local anesthesia. Of course the cystocele and rectocele are not entirely cured, but the patients are made much more comfortable, inasmuch as a large mass no longer projects from the vagina.

Finally, in those cases which for any reason cannot be operated on we have a very efficient method of treatment in the use of the Menge pessary.

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DISCUSSION

Dr. Barton Cooke Hirst: I have listened to Dr. McGlinn's paper with a great deal of interest, and feel that I must compliment him on his careful study of the literature. Like everybody engaged in this line of work, the cure of prolapsus uteri is a problem which is constantly presented to me. I have been obliged to formulate my own ideas on this matter for some time past. I find today in dealing with this subject in my two clinics in the University and the Howard Hospitals, that I have two forms of operation to depend upon: One in the child-bearing woman, the young woman living with her husband and expecting future childbirths. In these I can report successful results lasting fifteen years or more by the combination operation of amputation of the cervix with shortening of the cardinal ligaments in the base of the broad ligaments, restoring the fascia of the anterior wall, and an operation upon the pelvic floor which restores the anatomical conditions there perfectly. And in this respect I must differ from Dr. McGlinn in that I believe that anatomical restoration of the pelvic floor can be accomplished. The other operation, the one which I use in women no longer expecting to bear children, is amputation of the cervix as a rule and an operation midway between the operation of Watkins and the Mackenrodt operation. Instead of fastening the uterine body to the mucous membrane of the vagina I get better results, as a rule, by pushing it back again and sewing it over the vaginal wall. By this procedure I can often get better results than by the typical

Watkins operation. Dr. Schumann recently told me of a disadvantage in the Watkins operation in 2 cases out of 30 in which there occurred prolapse of the fundus uteri out of the vulvar orifice, a result which must sometimes be expected from the Watkins operation. But if the uterus is small and the fundus uteri not too bulky the Watkins operation answers very well. In case the uterus is diseased, if, for example, there is a suspicion of malignancy or metrorrhagia, I am doing a combination of the Goffe and the Mayo operation, namely a complete hysterectomy with interposition of the stumps of the broad ligament.

Dr. John M. Fisher: I noticed by the program that this was to be a paper on "Complete Prolapse of the Uterus." It seems to me, however, that the paper covers the whole subject of every other form of prolapsus with but little if any reference to the diagnosis and treatment of complete prolapse. There is as much difference between the first degree of prolapse and complete prolapse as between anteflexion of the uterus and retroflexion of the uterus. So far as the treatment of prolapse of the uterus is concerned, I depend upon the degree of prolapse and the structures involved. In prolapse of the uterus we may have vagino-uterine prolapse in which the vaginal walls first prolapsed, dragging the uterus downward; or there may be uterovaginal prolapse in which the uterus is prolapsed and drags the vaginal walls downward and forward. The treatment of these two conditions as a rule is disimilar. Uterovaginal prolapse not infrequently occurs without any laceration or relaxation of the pelvic floor. I have seen almost complete prolapse of the uterus in women who had not born children. Vagino-uterine prolapse in women who have borne children usually occurs as a result of traumatism during labor often without a visible laceration. No doubt, gentlemen, those of you who have done obstetric work can well recall in watching the head descend into the vagina seeing a cuff of the vaginal wall preceding the head before delivery, indicating that the vaginal wall was thus pushed off from the subjacent structures which subsequently resulted in the formation of an anterior colpocele erroneously called cystocele. In vagino-uterine prolapsus of the first degree cure may be effected by simple correcting the condition of the vaginal walls and restoring the functional activity of the musculature of the vagina. This is not done by many who do perineal operations. In many cases the operation has been a superficial dissection such as many of us see following operations for ventral hernia. The structure has been dissected away without bringing together the musculature and aponeurosis. In vagino-uterine prolapse of the second degree by shortening the round ligaments, resecting the vaginal walls anteriorly and

posteriorly and doing a functional restoration of the pelvic floor so effectively that the posterior vaginal wall will be found in contact with the anterior vaginal wall six months after the operation will generally effect a cure. The interposition operation in suitable cases of complete prolapse of the uterus, with true cystocele or removal of the uterus and fastening of the vaginal walls to the upper angles of the broad ligaments give the best results.

THE CHEMOTHERAPY OF MERCURIAL COMPOUNDS*

By JAY FRANK SCHAMBERG, M.D.,
JOHN A. KOLMER, M.D., and GEORGE W. RAIZISS, Ph.D.

The new science of chemotherapy has had its origin and its greatest impetus in the epoch-making researches of the distinguished and late lamented Paul Ehrlich. To the genius of this versatile chemist and biologist the world owes not only its conception of the principles of biochemical affinities, but also the practical fruition of these in the form of the most remarkable synthetic chemical compound known to man.

Ehrlich's interest in this subject dates back to his student days when he was attracted by an article by Heubel on lead poisoning; the anchoring of lead by the cells of the liver was doubtless the initial observation that suggested the thought of selective affinities between protoplasm and chemical substances. Ehrlich's attention was then devoted to the influence of dyes such as fuchsin and methylene blue upon various tissues. His researches in dyestuffs led to his remarkable work on the differential staining of the blood cells, the demonstration of acid-fast fixation of tubercle bacilli, the diazo reaction of the urine, the methylene-blue reaction on living nerve substance, etc. Later came the enunciation of his stimulating "side-chain theory." His systematic investigations in chemotherapy began with the elaboration of a pollyazo-dyestuff, which was capable of destroying trypanosomes, and which was consequently named "trypan-red." Compounds of phosphorus,

* Read January 3, 1917. From the Dermatological Research Laboratories of the Philadelphia Polyclinic.

antimony and arsenic were then studied in their various organic combinations. The demonstration that atoxyl, a combination of aniline oil and arsenic acid was capable of killing certain trypanosomes, was the awakening impulse that culminated, after painstaking and brilliant experimentation, in the elaboration of dioxydiamido-arsenobenzol dichlorhydrate, generally known as salvarsan.

Since the publication of Ehrlich's researches, investigators in different countries have turned their attention to mercury, a drug which has for 400 years been employed in the treatment of syphilis. Efforts have been made to create new mercurial compounds designed to exert a greater selective influence upon parasites, in particular, the spirochete of syphilis.

PREVIOUS RESEARCHES

Literature. The development of organic mercury compounds was much stimulated by the fundamental researches of Dimroth,[1] who definitely proved that in the so-called organic mercury salts—for instance mercury salicylate—the metal was attached to one of the carbon atoms of the benzene ring, and not the carboxyl group. Dimroth prepared a number of new organic compounds with one valence of the metal taken up by an organic and the other by an inorganic group—hydroxyl, halogen or acetic acid radical. L. Pesci[2] succeeded in 1901 in preparing mercury-dibenzoic acid, an organic compound with both mercury valences held by carbon atoms. E. Fischer and Mering[3] prepared in 1907 an analogous compound, *B*-mercury dipropionic acid, and found that it was considerably less toxic than the ordinary mercurial compounds. In 1911 Schrauth, Schoeller and Müller[4] determined the same low toxicity for Pesci's mercury-dibenzoic acid. They believed that the mercury was so firmly bound to the carbon atoms as to be practically deprived of its metallic properties. Indeed, after injections of the compound intramuscularly into animals, they found almost the entire quantity eliminated in the urine unchanged.

The last-named investigators,[5] during their researches extending over a period of years, prepared a number of new organic mercury compounds, and studied them as to the degree of toxicity manifested in animals, and as to their antiseptic effect on parasites in the test-tube. They claim to have established that the firmer mercury is bound to the organic radical, the less toxic does it become for the animal. Mercurials were divided by them into four classes: (*a*) inorganic, (*b*) pseudocomplex, (*c*) half complex, and (*d*) full complex compounds. In inorganic compounds mercury is precipitated by sodium hydroxide and certain other reagents; it on the other hand precipitates protein from solutions.

In pseudocomplex compounds mercury is ionized to a lesser degree. Dilute sodium hydroxide solution does not precipitate it; ammonium and hydrogen sulphide do. In half complex compounds, mercury is more firmly attached to carbon and is not precipitated by any of the three reagents referred to in cold, but only on boiling. The full complex compounds have each valence of mercury bound to an organic radical so firmly that even boiling with strong reagents is without effect.

Schrauth and Schoeller,[6] from their studies of large numbers of mercury compounds, are inclined to think that the therapeutically active substances are to be found in the class of half complex substances, because in full complex compounds the mercury is so firmly bound that it loses its chemical and biological characteristics; for instance, the toxicity of such products is low, and the antiseptic effect is insignificant. In the pseudocomplex and in the inorganic form, mercury is so readily split off as to be highly toxic.

The same authors claim that some of the new mercury compounds which they have prepared are superior to known mercurials; one of these has appeared on the market under the trade name of "Asurol." This is a double salt of sodium oxymercury-salicylate and sodium oxyisobutyrate containing about 40 per cent. of mercury. W. Kolle and Rothermundt[7] found it more toxic than mercury-salicylic acid (commonly called mercury salicylate) and of doubtful therapeutic value.

F. Blumenthal[8] and his co-workers have devoted considerable time and labor to an investigation of the toxicity and fate of mercury in the animal body. They believe that the therapeutic effect of mercury compounds bears a relationship to the extent to which mercury has an affinity for the cells of the liver, and as a result is deposited in this organ. Kolle and Rothermundt did not find this to be true in their experiments.

Blumenthal[9] studied the full complex mercury compounds prepared by Dr. Lüdecke, of Charlottenburg, and found that the diamino-mercuri-diphenyl-carboxylic acid, and analogous dinitro and dihydroxy compounds are of lower toxicity than ordinary preparations of mercury. However, the antiseptic properties of these compounds in the test-tube were *nil*, and in human syphilis, so far as could be determined by the published literature, they were of little value. The sodium salt of acetylaminomercuribenzoic acid (marketed under the trade name of "Toxynon") was prepared by Lüdecke and studied by Blumenthal; it is apparently a half complex compound and exhibited interesting biological properties in the earlier observations. It was later admitted by Blumenthal that it did not fulfil the expectations anticipated when the drug was employed in human syphilis.

Schilling, Von Krogh, Schrauth and Schoeller[10] carefully investigated the action of organic mercury compounds in experimental spirochetic infections. Chicken spirillosis was found to be too feeble an infection to furnish conclusive data as to the curative influence of mercurial compounds, inasmuch as untreated animals frequently recovered from the experimentally induced disease.

Mercurial compounds were then tried out in mice infected with the spirochete of Obermeyer, the cause of relapsing or recurrent fever. A number of known compounds of mercury and new compounds prepared by the authors were tested and found to be of little value in combating this disease. Five new preparations, the chemical constitution of which was not disclosed, were regarded by the authors as superior to the others. Nothing appears, however, to have been further published concerning the therapeutic value of these preparations. The authors arrived at the conclusion that the

spirochete of relapsing fever in mice is not favorably influenced by mercurials, as both the infection and the medicament are too injurious to the intestines. The possibility of mercury having a stimulating effect upon the production of antibodies in the infected animal is a thought expressed by the authors, who hold that the same cannot be claimed for salvarsan, which has such a destructive effect upon the parasites that their antigenic properties are lost.

Kolle and Rothermundt[11] regarded chicken spirillosis as a favorable experimental infection to work with. Known mercurials which possess value in the treatment of syphilis, exhibit a favorable influence in chicken spirillosis. This fact makes the infection with the Spirocheta gallinarum a good test for the determination of the value of new mercurial compounds. Experiments with "Asurol," dinitro-mercuri-diphenyl-carboxylic acid and other new synthetic mercury compounds, demonstrated that they were not superior to any of the known preparations. The working hypothesis advanced by Blumenthal, that therapeutically active mercurial compounds must possess an affinity for liver cells, and the opinion of Schrauth and Schoeller concerning the necessity of mercury being firmly attached to the organic molecule in half complex form, were not concurred in by the authors; they invoked data based upon actual experimentation in support of their adverse views. They held that the therapeutic value of a mercurial preparation bore no relationship to the firmness of mercury in the molecule nor to the fact that the compound was a precipitant for protein, nor to the solubility or insolubility of the compound. The establishing of the therapeutic index was regarded by them as most important, *i. e.*, the relationship of the *dosis lethalis* to the *dosis therapeutica*, as proposed by Ehrlich.

Knolle highly recommended a new compound prepared in his laboratories which belonged apparently to the pseudocomplex class and which was insoluble. This compound was placed upon the market under the trade name of "Argulan;" its chemical constitution shows it to be a sulfamino-antipyrene mercury compound. It is claimed by the authors that this preparation is as

efficacious in the treatment of relapsing fever infection in mice as is salvarsan.

The therapeutic index in chicken spirillosis infection was found to be as high as $\frac{1}{100}$; *i. e.*, the relation of the curative dose to the toxic dose was 1 to 100. Argulan is claimed to be less organotropic than mercurial compounds. It is administered to man by intramuscular injection in oil, and exhibits favorable effects in the treatment of syphilis.

Hahn and Kostenbader[12] studied the pharmacological, physiological and therapeutic properties of a number of dyestuffs combined with mercury. Three classes of new compounds* were investigated; mercury-phthaleins, mercury-anthrachinons and mercury-azodyes. The toxic dose was tested on mice and chickens. The therapeutic dose was tested out on chicken spirillosis. The authors claim to have obtained very favorable results in combating the infection with mercury dyestuffs, the therapeutic index being with many of the compounds close to $\frac{1}{100}$. No relationship was found whatsoever between the toxicity and therapeutic effect on the one hand, and chemical and physical properties such as mercury content, solubility and ionization, on the other. The toxicity and curative effect apparently are to be explained by differences in the finer structure of the molecule. No "leads" could be found by the authors and therefore purely empirical investigation of whole groups of mercury compounds was proposed as the best possible way of securing an efficient therapeutic agent.

CHEMOTHERAPEUTIC STUDIES OF NEW MERCURIAL COMPOUNDS

In the following pages a study of the biological properties of a number of mercury compounds is presented. Some of these compounds were already known chemically, although we were not cognizant of this fact when they were prepared by us in our laboratories. Certain other of the mercury compounds referred to are,

* These compounds were prepared by Saccharin Fabrik, actien gesell. Vorm, Fahlberg, List & Co., Magdeburg, Germany.

to the best of our knowledge, new, and prepared for the first time by us. These new preparations belong, for the most part, to the group of half complex substances, the type which previous investigators believed to be the most fruitful source of therapeutically active compounds. In investigative work in this field, there are but few definitely established principles so that the researches must be in the beginning largely empiric. It is obvious, however, that without some systematic scheme in mind one might labor for years without practical results. To combine mercury in a haphazard manner with every chemical substance that suggested itself to one's mental vision, might by some fortuitous circumstance, eventuate in the production of a useful compound, but no scientific program could be mapped out along such lines. We endeavored to combine mercury with representatives of different groups of organic substances in order to find a "lead." Whenever one type of compound proved interesting, by reason of low toxicity combined with high parasiticide effect *in vitro* or *in vivo*, derivatives and substitution products of such substances were made and tested out. This work has been continued for about two years, and only recently have we been able to produce compounds of high promise. These are under study at the present time and consequently but brief mention of them will be made in this communication.

The following are some of the principal groups with which we have combined mercury; the resultant compounds were tested out on animals for toxicity and therapeutic effect, and their parasiticide properties studied in the test-tube.

(*a*) Naphthol and Naphthylamine.
(*b*) Benzidine.
(*c*) Phenol.
(*d*) Dihydroxybenzene.
(*e*) Aminophenyl-arsenic acid.

The chemical properties and constitution of these compounds will be described and published elsewhere, inasmuch as their inclusion in this paper would expand it to undue proportions.

PLAN OF PROCEDURE

Our plan of procedure was first to study the toxicity of new compounds by injection of the substance into rabbits and into rats. Soluble compounds were administered intravenously to rabbits and the immediate dosis lethalis determined. The dosis tolerata was ascertained by graded amounts given intravenously to white rats. Insoluble products, of course, had to be studied by intramuscular injection. The previous investigations carried out by us[13] on the toxicity of the various mercurial compounds in use, was an excellent guide in establishing comparative values.

The conclusions reached in the article referred to are here briefly set forth:

1. Rats exhibit such variation in resisting power to mercurial compounds, that too much weight should not be attached to minor differences in toxicity in experimental findings.

2. While the maximum tolerated dose of the various compounds may be widely divergent, when the doses are calculated in terms of pure mercury, they fall within relatively narrow limits.

3. In general terms, it may be stated that the toxicity of the various mercurial compounds is directly proportionate to the amount of pure mercury contained.

4. The inorganic salts, as represented by the bichloride of mercury, are no more toxic than the numerous organic combinations that are commonly employed.

5. The differences in the molecular structure of the mercury compounds tested by us were found to be of relatively little importance as affecting their toxicity.

6. The bichloride of mercury was fatal, on the average, intravenous doses above 2 milligrams per kilo of body weight; administered intramuscularly it was fatal on the average, above 6 mg. per kilo of body weight.

7. The average relationship as to the toxicity between the intravenous and intramuscular administration of mercury, in general, was about 4 to 1.

8. The insoluble preparations such as gray oil, calomel and the

salicylate of mercury are absorbed in rabbits at the rate of a little over 1 per cent. of the injected amount per day.

9. Even at the end of six or seven weeks, almost 50 per cent. of the mercury of insoluble preparations may be absorbed at the site of the injection in rabbits.

10. The injection of the usual doses of insoluble mercurial compounds at weekly intervals in the human subject, must invariably lead to accumulation of the drug in the tissues.

11. Insoluble mercurial injections should be given only by the skilled physician after careful consideration of the dose and of the intervals of administration.

12. Mercury has a great affinity for the cells of the kidney, and this organ is one of the earliest involved in mercurial intoxication. Hence during the intensive treatment with mercury the necessity of careful examination of the urine from time to time should be emphasized.

13. The nephritis produced by mercury is primarily tubular in variety; capsular glomerulonephritis of the exudative (hemorrhagic) variety is frequent and practically always accompanies severe tubular nephritis. Calcification of the degenerated tubular cells has been found in animals within forty-eight hours after the administration of mercury and always occurs in severe mercury nephritis, irrespective of the salt administered or the route of injection.

It is readily comprehended that a medicament of value must not only be therapeutically active, but its toxicity must be such as to permit its use without serious damage to organs. Drugs may be of low toxicity and of low therapeutic effect; they may possess high curative properties but may be extremely poisonous. The ideal medicament is one which has a maximum therapeutic influence and a minimum toxic effect. In searching for the chemical substances possessing the power to destroy vegetable or animal parasites, it is essential that the biologic laboratory should be in close and constant coöperation with the chemical laboratory.

We have found the most satisfactory scheme for the investigation of the parasiticide properties of chemical compounds to be as follows:

1. The determination of the effect of the compounds upon bacteria in the test-tube (*a*) by the germicidal test (Rideal-Walker), (*b*) by our so-called "antiseptic" test.

2. The determination of the effect of compounds upon trypanosomes and spirochetes in the test-tube.

3. The determination of the effect of compounds on parasites in the test-tube for definite periods, followed by the investigation of the infective power of the treated parasites by subsequent injection into animals. This is our so-called *test in vitro-vivo*.

4. The determination of the parasiticide and curative properties of compounds by injections into experimentally infected animals.

EXPERIMENTS IN VITRO

One may secure valuable information concerning the effect of medicaments upon bacterial life by studies of the action of the chemical substances under consideration, in the test-tube. These tests can be carried out with reasonable rapidity, and fortunately yield quite constant results. Within a few days one can determine whether a given compound is capable of killing the staphylococcus, the Bacillus typhosus, the pneumococcus or any other bacterium in the test-tube, and the quantity of the compound and the time necessary to produce such effect. In this manner the bactericidal value of compounds for special organisms may be determined and compared. This furnishes a valuable "lead," for the general proposition may be enunciated that substances which have a destructive effect upon bacteria in the test-tube are *more apt* to have a germicidal influence in the living body than those which do not. This method permits one to eliminate from further consideration the inert compounds, and to continue the study of those which appear most promising. The above proposition must not be construed as an intimation that germicidal substances *in vitro* are prone to prove germicidal *in vivo*, for numerous complicated factors are here involved. The investigator in chemotherapy must be prepared to suffer many bitter disappointments with compounds which are most promising in the test-tube and inert or relatively inert in the experimental animal.

GERMICIDAL OR RIDEAL–WALKER TEST

The technic of the germicidal test which we have employed is here briefly set forth:

These tests were conducted after the standard method employing varying dilutions of the chemical and a twenty-four-hour broth culture of B. typhosus.

Dilutions of the chemical under study were prepared in distilled water and placed in amounts of 5 c.c. in sterile test-tubes in a water-bath at 20° C. held in a special rack designed for these tests. Each five dilutions were then seeded with 0.1 c.c of a twenty-four-hour broth culture of B. typhosus and subcultures made at intervals of 2½ minutes up to 15 minutes, with a 4-mm. platinum loop and into tubes containing 10 c.c. of standard broth.

The results were recorded after forty-eight hours' incubation at 37° C; with practice the method was found to yield uniform results. The results summarized in Table I were secured after several experiments with each compound to insure accuracy and constancy of result.

With each experiment phenol was employed in five different dilutions and the results of the tests with the mercurial compounds expressed in comparison with the germicidal activity of phenol (called the "phenol coefficient"). This comparison may be made with the 2½- or 15-minute periods of exposure as summarized in Table I, or, by averaging the results of the 2½- and 15-minute exposures, as is the practice in the standard test for determining and expressing the phenol coefficient.

TABLE I.—PHENOL COEFFICIENTS OF MERCURIAL COMPOUNDS FOR β-TYPHOSUS IN RIDEAL–WALKER METHOD

No.	Chemical compound	Exposure in minutes	
		2½	15
	Mercuric chloride	300	300
42	New mercuric compound, No. 42	5,000	10,000
99	New mercuric compound, No. 99	10,000	10,000
100	Mercury-nitrosalicylic acid	100	100
105	New mercuric compound, No. 105	10,000	10,000

In Table I is observed the germicidal action on the typhoid bacillus of mercuric chloride (bichloride of mercury), and of several new mercury compounds prepared in our laboratory. It will be seen from an inspection of the figures, that the new compounds are incomparably superior to phenol and possess, moreover, a striking superiority over bichloride of mercury, which hitherto in our experience has been the best mercurial germicide in the test-tube. One of the new compounds, No. 99, is shown by this experiment (and this was repeated on several occasions) to be 300 times more germicidal than bichloride of mercury. This is shown in Table I.

It will be seen from this table that bichloride of mercury has 300 times the germicidal value of phenol, and that two of the new mercuric compounds have 10,000 times the germicidal value of phenol.

In the subjoined table (Table II) are represented the antiseptic values of a number of mercuric compounds, both known and new. Without going into detail it will be seen that the values vary very greatly and that the antiseptic effect of the various compounds is not related to the content of pure mercury in the substance, but rather to the chemical constitution of the molecule. It is of particular interest to note that the new mercurial compound No. 99 has exhibited the maximum effect by the antiseptic test, just as it has equalled the highest coefficient by the germicidal method. Many of the new mercuric compounds made by us exceed bichloride of mercury in antiseptic power. No. 99 kills the Staphylococcus aureus in a dilution of 1 to 5,000,000, whereas bichloride of mercury kills only in a dilution of 1 to 100,000.

As a matter of general interest in connection with this test, the antiseptic value of salvarsan and arsenobenzol (Dermatological Research Laboratories) is likewise given. It will be seen that they both kill the staphylococcus in dilution of 1 to 2000 and thus show a marked inferiority as compared with bichloride of mercury.

It is proper to add that these tests were made three times in order to eliminate, so far as possible, errors in the result.

TABLE II.—BACTERICIDAL ACTIVITY OF MERCURIAL COMPOUNDS IN THE "ANTISEPTIC" TEST

Laboratory number of compound	Chemical compound	Bactericidal dilution	
		Staph. aureus	β-typhosus
42*	New mercury compound No. 42	1 : 1,000,000	1 : 500,000
41*	Hexamethylenetetramine mercuric acetate	1 : 330,000	Not performed
104*	Mercury-amino-salicylic acid	1 : 250,000	"
100*	Mercury-nitrosalicylic acid	1 : 500,000	"
95*	Mercury-nitrophenylarsenic acid	1 : 110,000	"
96*	Mercury-amino-oxyphenylarsenic acid	Less than 1 : 100,000	"
97*	Dimercury-diacetyldiamino-oxyphenylarsenic acid	1 : 200,000	"
98*	New mercury compound No. 98	1 : 330,000	"
99*	New mercury compound No. 99	1 : 5,000,000	"
9	Resorcin-mercuric acetate	1 : 500,000	"
101	Thymol mercuric acetate	1 : 330,000	"
2	β-naphthol-mercuric acetate	Less than 1 : 100,000	Less than 1 : 100,000
39*	Sulpho-β-naphthylamine-mercuric acetate	Less than 1 : 100,000	Less than 1 : 100,000
41	Hexamethylenetetramine-mercuric acetate	Less than 1 : 100,000	Less than 1 : 100,000
	Mercuric chloride (bichloride) of Hg.	1 : 160,000	1 : 200,000
	Calomel	1 : 140,000	1 : 160,000
	Mercury-benzoic acid	1 : 160,000	1 : 160,000
	Mercury-cacodylic acid	1 : 100,000	1 : 100,000
	Mercury-salicylic acid	1 : 160,000	1 : 200,000
	Arsenobenzol	1 : 2000	1 : 2500
	Salvarsan	1 : 2000	1 : 2500

* New mercury compounds prepared in our laboratories. Performed in triplicate.

Technic. In conducting this test small numbers of the test microörganism were exposed to high dilutions of chemicals over a period of several days.

The stock solutions of chemicals were prepared by dissolving 0.01 mg. in 100 c.c. of sterile distilled water. Amounts varying from 0.1 c.c. to 1 c.c. were then placed in a series of ten sterile test-tubes of appropriate size followed by the addition of sufficient plain neutral and sterile broth to make the total volume in each tube 10 cubic centimeters. Each tube and several controls were then seeded with 0.05 c.c. of a twenty-four-hour broth culture of Staphylococcus aureus. All cultures were incubated at 37° C. for about five days when the results were recorded. Sterility was indicated by perfectly clear tubes and in many instances these results were checked by further subcultures to determine whether or not actual death of all cocci had occurred rather than an inhibition. Read-

ings made at the end of twenty-four hours were always higher than those made after the expiration of five days; the former may be designated the antiseptic or inhibiting dose and the latter the germicidal or killing dose. Further details regarding this method which we have found very simple and remarkably uniform in its results will be found in our former publications.[14 15]

BACTERICIDAL ACTIVITY IN A MENSTRUUM OF SERUM (PIPETTE METHOD)

Of considerable importance in relation to the bactericidal activity of compounds *in vitro* and to the problems of the chemotherapy of bacterial infections, is the question of the maintenance of the bactericidal activity of a given substance in a menstruum of serum. With many substances as bichloride of mercury and phenol, the bactericidal values are considerably lower in serum than in normal salt solution or nutrient broth. In general terms the compound which maintains a high degree of bactericidal activity *in vitro* in a menstruum of serum or ascites fluid is to be regarded as superior inasmuch as the conditions of such an experiment approach more closely those existing in the living body. We have tested a number of mercurial compounds both known and by the new pipette method, the technic and results appearing in the following table (Table III).

Technic. In this method varying dilutions of the chemical under study were prepared in sterile ascites fluid in a series of small sterile tubules in amount of 1 cubic centimeter. To each tubule was then added 0.2 c.c. of twenty-four-hour broth culture of B. typhosus followed by gentle mixing. At intervals of 5, 15, 20 and 30 minutes a small amount of each dilution was cultivated in broth contained in the bulbous portions of capillary pipettes. We have also conducted this test by using one capillary pipette marked to carry a definite volume, and transferring an equal amount of each dilution to tubes containing 10 c.c. of broth. The pipette is sterilized between each transfer by several washings with boiling salt solution placed alongside of the worker. In this manner the

amount of drug actually transferred is quite small and undergoes very high dilution in the broth so that any resultant germicidal action takes place in the menstruum of ascites fluid or blood serum. The results of tests shown in Table III were conducted in this manner. All tubes or pipettes were incubated for three days and the results read and checked by subcultures.

Further details of this method, which we have found best suited for germicidal tests in a menstruum of serum, will be found in one of our former communications.[16]

TABLE III.—BACTERICIDAL ACTIVITY OF PHENOL AND MERCURIAL COMPOUNDS UPON STAPHYLOCOCCUS AUREUS IN A MENSTRUUM OF ASCITES FLUID (PIPETTE METHOD)

No.	Chemical compound	Bactericidal		Bichloride coefficient (5 minutes)
		5 min.	30 min.	
	Mercuric chloride	1 : 8000	1 : 32,000	
	Phenol	Less than 1 : 40	Less than 1 : 40	
	New mercury compound No. 42	1 : 400,000	1 : 800,000	50
	New mercury compound No. 99	More than 1 : 1,600,000	More than 1 : 1,160,000	200
	Mercury nitro-salicylic acid	1 : 50,000	1 : 50,000	6
	New mercury compound No. 105	1 : 400,000	1 : 1,160,000	50

As shown in Table III, two of our new mercurial compounds (No. 42 and No. 105) exhibited a bactericidal activity in ascites fluid 50 times higher than that exerted by bichloride of mercury, while our new compound No. 99 was found 200 times more powerful.

SPIROCHETICIDAL ACTIVITY OF SALVARSAN, ARSENOBENZOL (DERMATOLOGICAL RESEARCH LABORATORIES) AND MERCURIAL COMPOUNDS IN VITRO

The superiority of salvarsan and arsenobenzol as spirocheticidal compounds is demonstrable by tests *in vitro*. The results of a few such tests with these and mercurial compounds are shown in Table IV; we have not been able to repeat these experiments frequently enough to present the results as absolute, and further studies may

necessitate a revision of the values shown, but the results are sufficiently conclusive to demonstrate a spirocheticidal activity of salvarsan and mercurial compounds *in vitro* for the spirochete of syphilis; the former are more active in this respect. All of the experiments shown in Table IV were conducted with the same strain of pallida and within a few days of each other, so that the variations in results may be attributable to the different products or slight errors in technic.

The technic employed was as follows:

Technic. These tests were conducted with a pure culture of Spirocheta pallida received some months previously from Dr. Hans Zinsser (strain A). The spirochetes of this culture grew well in appropriate solid and fluid culture media.

TABLE IV.—THE SPIROCHETICIDAL ACTIVITY OF SALVARSAN, ARSENOBENZOL (DERMATOLOGICAL RESEARCH LABORATORIES) AND MERCURIAL COMPOUNDS FOR SPIROCHETA PALLIDA IN VITRO*

Final dilutions	Compounds					
	Salvarsan No. A	Salvarsan No. B	Arsenobenzol No. A	Arsenobenzol No. B	Bichloride of mercury	New mercurial compound No. 2
1 : 20	−**	−	−	−	−	−
1 : 40	−	−	−	−	−	−
1 : 80	−	−	−	−	−	−
1 : 160	−	−	−	−	−	−
1 : 320	−	−	−	−	+	−
1 : 1000	−	−	−	−	+	−
1 : 2000	−	−	−	−	+	+
1 : 4000	+***	−	−	+	+	+
1 : 8000	+	−	−	+	+	+
1 : 16000	+	−	−	+	+	+
1 : 32000	+	−	−	+	+	+
1 : 64000	+	−	−	+	+	+
1 : 128,000	+	+	−	+	+	+
1 : 256,000	+	+	+	+	+	+
1 : 512,000	+	+	+	+	+	+

*All controls yielded good growths of Sp. pallida.
**Sterile.
***Growth of S. pallida.

A stock solution of the compound under study was prepared in sterile distilled water and varying dilutions in amounts of 1 c.c. prepared in a series of sterile test-tubes with sterile broth. To each

tube of this series and several controls was added 1 c.c. of a fluid ascites broth culture of pallidum, which had been gently shaken with sterile beads to break up clumps and which showed in each microscopic field about forty or more active spirochetes by dark-field illumination. After gentle mixing the tubes were incubated for two hours at 37° C. when a piece of sterile rabbit kidney and eight cubic centimeters of ascites agar were added to each tube. This made the dilution ten times greater, but those given in the adjoining table were the dilutions of drug to which the spirochetes had been exposed prior to the addition of the culture medium. No doubt the influence of the compounds was continued after dilution with ascites agar. Each tube was covered with sterile paraffin oil and incubated at 37° C. for three to five weeks. At the end of this time each tube was examined by dark-field illumination for active spirochetes by removing portions of the medium at different levels with sterile capillary pipettes. All of the controls showed numerous active spirochetes; it was found impossible to express an opinion as to diminution in numbers of spirochetes as the number varied in different parts of the culture medium. The results, therefore, are expressed as sterile or showing a growth, and are given in Table IV.

THERAPEUTIC EXPERIMENTS IN ANIMALS

Method of Study. In our investigation of the action of mercury and arsenicals in animal infections the following four parasites have been employed: the Spirocheta recurrentis (the parasite of relapsing fever), the Trypanosoma brucei (the parasite of Nagana disease of horses), the Trypanosoma lewisi (a saprophytic parasite in rats), and the Trypanosoma equiperdum (the parasite of "la dourine" or horse syphilis).

Inasmuch as the influence of the drug administered on the duration of life of the infected animals is one of the important criteria of its efficiency, we found the Trypanosoma lewisi unsatisfactory because it does not as a rule kill the animal. The spirochete of

relapsing fever leads to confusing results because of the frequent remissions and the disappearance of the parasite from the peripheral blood. The Trypanosoma brucei kills rats within a few days, a period too short to study the effects of the weaker agents. The Trypanosoma equiperdum was found admirably adapted to the purposes of our studies, and was the parasite generally employed by us. It kills the rats within four to seven days after infection, depending upon the infecting dose and upon the virulence of the strain.

Our investigations latterly have been carried out routinely against the Trypanosoma equiperdum inoculated into white rats.

Technic. Our therapeutic test is conducted by injecting rats intravenously with a dose of the drug corresponding to body weight, twenty-four hours after the animals have been infected by injecting the test microparasite intraperitoneally. In this manner the infection has a start of twenty-four hours and is well established before the drugs are administered. All intravenous injections are given into the external jugular vein which permits the injection of accurate doses. Each animal is weighed and individual doses are prepared according to 100 grams of body weight. In each experiment four control animals are included; these are infected but receive no drug.

Of considerable importance in these tests is the number of microparasites used in infecting the experimental animals. Infection with very large numbers of pathological trypanosomes yields an overwhelming infection which effectually obscures any therapeutic result.

In our experiments the animals are infected with approximately known numbers of trypanosomes after the method of Kolmer and in such a manner as to result in a regular and uniform infection without being overwhelming. The importance of this numerical relationship of infection to experimental trypanosomiasis has been studied experimentally and our results reported elsewhere.

The blood of each animal is examined daily and the number of parasites in the peripheral blood recorded after the following scheme:

few = one or two per field or every other field.
\+ = about 5 to 10 in a field.
++ = about 10 to 20 in a field.
+++ = large numbers that may be roughly, but not accurately counted.
++++ = very large numbers; cannot be counted.

The effects of a chemical are studied by its power to permanently sterilize or its power of inhibiting the proliferation of the microparasite and prolonging the life of the animal. These effects are readily determined by comparison with the controls.

In Table V, VI and VII are noted the effects in experimental trypanosomiasis of a number of commonly employed mercurial compounds:

TABLE V.—INFLUENCE OF MERCURIAL COMPOUNDS ADMINISTERED INTRAVENOUSLY TWENTY-FOUR HOURS AFTER INFECTION WITH T. EQUIPERDUM*

Subst.	No.	Wt. in gms.	Dose per 100 gms.	Daily examinations						
				1	2	3	4	5	6	7
Mercuric chloride	1	85	.0003	–	Few	D				
	2	89	.0002	–	Few	++	++++	D		
	3	100	.0001	–	Few	++	++++	D		
	4	111	.0001	–	Few	+	++	++++	D	
Mercury-benzoic acid	5	62	.0003	–	++	D				
	6	52	.0003	–	+	++++	++++	D		
	7	60	.0002	–	+	++++	++++	++++	++++	D
	8	42	.0001	–	++	++++	++++	++++	D	
Mercury-succinimide	9	49	.0003	–	+	++++	++++	D		
	10	63	.0003	–	+	+++	+++	++++	D	
	11	66	.0002	–	+	++	++++	++++	++++	D
	12	55	.0001	–	+	+++	++++	D		
Mercury-cacodylic acid	13	61	.0003	–	+	+++	++++	++++	D	
	14	75	.0003	–	+	++	+++	D		
	15	54	.0002	–	+	++++	++++	++++	D	
	16	48	.0001	–	+	++++	++++	D		
	17	48	Control	–	+	++	++++	++++	++++	D
	18	66	Control	–	+	+++	++++	D		
	19	54	Control	–	+	++	++++	++++	++++	D
	20	50	Control	–	+	++	++++	++++	D	

*Rats infected with 120,000 trypanosomes by intraperitoneal injection.
D signifies death of animal.

It will be seen that the injections of bichloride of mercury and the other mercurials in doses as large as can be borne by the animal have no material influence in lessening the number of trypanosomes in the blood nor of prolonging the life of the animal. This can be readily determined by comparison with the control rats, which of course did not receive any medication.

Table VI exhibits the results of the administration of a number of mercurials made in our laboratory. As will be observed, none of these have been able to inhibit the multiplication of the parasite, nor of prolonging life.

In Table VII the effect of several new mercurial compounds which gave brilliant results as bactericides is shown. In two instances an inhibitory influence is noted at the end of 48 hours, but all of the animals died shortly after the death of the controls.

TABLE VI.—INFLUENCE OF MERCURIALS ADMINISTERED INTRAVENOUSLY TWENTY-FOUR HOURS AFTER INFECTION WITH T. EQUIPERDUM*

Subst.	No.	Wt. in gms.	Dose per 100 gms.	Daily examinations				
				1	2	3	4	5
No. 2 β-naphthol-mercuric acetate	1	60	.0003	–	+	++	++++	D
	2	72	.0002	–	+	++	D	
	3	72	.0001	–	+	++++	++++	D
	4	73	.00005	–	+	++	++++	D
Hexamethylene-tetramine-mercuric acetate	5	62	.0003	–	+	D		
	6	67	.0002	–	+	D		
	7	79	.0001	–	+	++++	++++	D
	8	69	.00005	–	Few	++	++++	D
Sulpho-β-naphthylamine-mercuric acetate	9	139	.0003	–	+	++	D	
	10	109	.0002	–.	++	+++	D	
	11	97	.0001	–	+	++++	++++	D
	12	132	.00005	–	+	++++	D	
Mercury-aminophenyl-arsenic acid	13	151	.0005	–	Few	+++	D	
	14	128	.0004	–	Few	+	++	D
	15	100	.0003	–	–	+	++++	D
	16	96	.0002	–	+	++	++++	D
	17	83	Control	–	+	++	++++	D
	18	67	Control	–	+	+++	D	
	19	64	Control	–	+	++	++++	D
	20	63	Control	–	+	+++	++++	D

*Rats infected with 90,000 to 124,000 trypanosomes by intraperitoneal injection.

Space will not permit a detailed tabular presentation of the various experiments with different microparasites. It will perhaps suffice to summarize these in the following tables, VIII and IX:

In the above table the summarized results of the maximum dose of various mercurial compounds is given. In a general way it is seen that the new compounds exhibit a slightly restraining influence upon the appearance of trypanosomes in the blood, whereas this result is not obtained by the bichloride of mercury, although this substance contains a much higher percentage of mercury (73 per cent.).

It must be remembered that in biological work of this character discrepancies will arise from time to time, owing to differences in the virulence of the infecting strain, the individual resistance of the rats and other complex factors. Mathematically precise results cannot be hoped for in investigations of this character. It is only by frequent repetition of experiments and careful comparison

TABLE VII.—INFLUENCE OF MERCURIAL COMPOUNDS ADMINISTERED INTRAVENOUSLY TWENTY-FOUR HOURS AFTER INFECTION WITH T. EQUIPERDUM*

	No.	Wt. in gms.	Dose per 100 gms.	Daily examinations				
				1	2	3	4	5
New mercury compound No. 99	1	85	.0008	–	D			
	2	134	.0007	–	++	D		
	3	99	.0006	–	++	D		
	4	80	.0004	–	++	D		
Mercury-nitro-oxyphenyl-arsenic acid	5	82	.0012	–	–	Few	+++	D
	6	94	.001	–	+	++++	D	
	7	78	.0008	–	++	D		
	8	64	.0006	–	++	++++	D	
Mercury-nitrosalicylic acid	9	109	.0008	–	++	++++	D	
	10	64	.0007	–	++	++++	+++	D
	11	55	.0006	–	++	+++	D	
	12	107	.0004	–	++	D		
New mercury compound No. 105	13	82	.0008	–	+	++++	++++	D
	14	109	.0007	–	–	+	++	D
	15	85	.0006	–	Few	++	D	
	16	110	.0004	–	++	++++	D	
	17	80	Control	–	++	D		
	18	79	Control	–	++	++++	D	
	19	89	Control	–	++	D		
	20	59	Control	–	++	++++	D	

*Rats infected intrapefitoneally with 250,000 trypanosomes.

of the conditions under which they are conducted that the results can be scientifically reconciled.

TABLE VIII.—INFLUENCE OF MERCURIAL COMPOUNDS ADMINISTERED INTRAVENOUSLY TWENTY-FOUR HOURS AFTER INFECTION WITH SP. OBERMEIERI

Laboratory number of compound	Name of compound	Maximum dose per 100 gms.	Equivalent per 60 K. (125 lbs.)	Effect on spirochetes.
28*	β-naphthylamine-azo-β-naphtholmercuric acetate	.01	6.0	Inhibition for 6 days
24	Mercury-benzoic acid	.0004	0.24	None
30*	Sulpho-β-naphtholmercuric acetate	.0008	0.48	None
2	β-naphthol-mercuric acetate	.0006	0.36	Inhibition for 24 hrs.
27*	Amido-benzol-sulpho-azo-β-naphthol-mercuric acetate	.001	0.6	None
	Mercury	.0003	0.18	None
	Mercury-salicylic acid	.0004	0.24	None

*New compounds made in our laboratories.
*This compound is commonly but erroneously termed mercury salicylate.

TABLE IX.—INFLUENCE OF MERCURIAL COMPOUNDS ADMINISTERED INTRAVENOUSLY TWENTY-FOUR HOURS AFTER INFECTION WITH T. EQUIPERDUM

Laboratory number of compound	Name of compound	Maximum dose per 100 gms. body wt.	Equivalent per 60 K. (125 lbs.) body wt.	Effect on trypanosomes
95*	Mercury-nitro-oxyphenylarsinic acid	.0012	0.72	None
71*	Mercury-amino phenylarsinic acid	.0005	0.3	None
6	β-naphthol-mercuric oxide	.0003	0.18	Inhibition for 24 hrs.
2	β-naphthol-mercuric acetate	.0006	0.36	None
27*	Amido-benzol-sulpho-azo-β-naphthol-mercuric oxide	.001	0.6	None
3*	Mercury-o-sulphamid benzoic acid	.00058	0.348	None
41*	Hexamethylene-tetramine-mercuric acetate	.0004	0.24	None
39*	Sulpho-β-naphthylamine mercuric acetate	.0003	0.18	Inhibition for 24 hrs.
42*	New mercuric compound No. 42	.0004	0.24	Inhibition for 24 hrs.
	Mercury succinimide	.0004	0.24	None
	Mercury-cacodylic acid**	.0004	0.24	None
	Mercuric chloride	.0003	0.18	None
	Mercury-benzoic acid**	.0003	0.18	None or inhibition for 24 hrs.
	Mercury oxycyanide	.0002	0.12	None
	Mercury-salicylic acid**	.0004	0.24	None
	Mercury sozoiodolate	.0003	0.18	None

**These compounds are commonly but erroneously termed mercury salicylate, mercury cacodylate, etc.
*New compounds made in our laboratories.

The experiments above referred to constitute a most severe test of the action of a parasiticide agent, inasmuch as the infection is given 24 hours' start before the medicament is injected into the blood stream. The following table (Table X) exhibits the results of an experiment in which the infection is given merely two hours' start, before the remedial drug is infused into the viens. The new mercurial compounds were chiefly tested by this method and varying degrees of inhibition are observed. In one instance the blood was kept free of parasites for four days.

TABLE X.—INFLUENCE OF MERCURIAL COMPOUNDS ADMINISTERED INTRAVENOUSLY TWO HOURS AFTER INFECTION WITH T. EQUIPERDUM

Laboratory number of compound	Chemical compounds	Maximum dose per 100 gms.	Equivalent per 60 K. (125 lbs.)	Effect on trypanosomes
99	New mercury compound No. 99 . . .	.0008	0.48	Inhibition for 4 days
95	Mercury-nitro-ox yphenylarsenic acid .	.0012	0.72	None
100	Mercury-nitrosalicylic acid	.0008	0.48	Inhibition for 24 hrs.
105	New mercury compound No. 105 . .	.0008	0.48	Inhibition for 24 hrs.
42	New mercury compound No. 42 . . .	.0007	0.42	Inhibition for 24 hrs.

As indicating the great superiority of salvarsan and its congeners over mercury in experimental trypanosomiasis, the following table (Table XI) is presented. Here the picture is quite different from those shown above.

Numerous experiments carried out by us show that salvarsan in the dose of 15 mg. per kilo of body weight is capable of sterilizing white rats infected with the T. equiperdum. Only with doses below this do the parasites appear in the blood, and the time of their appearance is in inverse ratio to the size of the subcurative dose administered. The chart also exhibits the therapeutic effect of the arsenobenzol prepared in our laboratories. Neosalvarsan is seen to be inferior in its effect to salvarsan. Salvarsan is likewise capable of sterilizing animals infected with the spirochete of relapsing fever, an organism more closely related to the organism of human syphilis.

THE TRYPANOCIDAL ACTIVITY OF VARIOUS COMPOUNDS IN THE COMBINED IN VITRO–VIVO TEST

During the course of chemotherapeutic studies compounds possessing a well-defined parasitotropic effect may be prepared which prove so highly organotropic or toxic for the test animal that the minute doses tolerated fail to exert an appreciable influence upon the parasites. The mercurials which are known to exert a powerful bactericidal effect *in vitro* are substances of this class, being so highly toxic that doses greater than 0.0004 gm. per 100 grams of white rat are apt to prove fatal and yet too small to materially influence the course of experimental trypanosomiasis.

In order, therefore, to avoid the mistake of discarding new compounds possessing a high degree of trypanocidal activity because they are highly toxic for experimental animals, a study of various methods of determining the trypanocidal activity of a drug independent to some extent of its toxicity for the body cells of the host, was undertaken with the result that we have succeeded in devising a valuable technic for these purposes. In the event of the preparation of a new compound which is highly toxic, but also possessing a high degree of parasitropism, our efforts are devoted toward lowering its toxicity to a sufficient extent to permit the administration of the drug to living animals.

We have studied various methods in detail, the results being given elsewhere;[19] according to these experiments our combined *in vitro-vivo* method yielded the most constant and reliable results.

Technic. In this method equal parts of varying dilutions of the chemical under study are mixed with blood-trypanosome emulsion and kept at 37° to 40° C. for 15 minutes, when the whole or a part is injected intraperitoneally into white rats to determine the degree of trypanocidal activity. As a part of the drug is injected the action of the drug is both *in vitro* and *in vivo*, and due care must be exercised against the administration of lethal doses of the drug.

Each rat is then kept under observation for at least two weeks and the blood examined daily for trypanosomes. In this manner the degree of trypanocidal activity may be determined according

TABLE XI.—INFLUENCE OF SALVARSAN, ARSENOBENZOL (DERMATOLOGICAL RESEARCH LABORATORIES) AND NEOSALVARSAN ADMINISTERED INTRAVENOUSLY TWENTY-FOUR HOURS AFTER INFECTION WITH T. EQUIPERDUM*

Subst.	No.	Wt. in gms.	Dose per 100 gms. body wt.	Results of daily examinations of blood from tail														
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Salvarsan B. F. U.	1	127	.004	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	2	90	.003	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	3	124	.002	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	4	112	.001	–	–	–	–	–	–	–	Few	+	++++	++++	D			
Arsenobenzol No. 54	5	97	.004	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	6	85	.003	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	7	89	.002	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	8	103	.001	–	–	–	–	–	–	–	–	–	–	Few	+	++	++++	D
Neosalvarsan	9	112	.004	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	10	82	.003	–	–	–	–	–	–	–	–	+	++	++++	++++	D		
	11	98	.002	–	–	–	–	–	–	–	Few	+	++++	++++	D			
	12	75	.001	–	–	–	–	–	–	Few	+	++++	D					
	13	90	Control	Few	++	++++	D											
	14	101	Control	Few	++	++++	D											
	15	75	Control	Few	++	++++	D											
	16	83	Control	Few	++	++++	++++	D										

*Rats infected with 180,000 trypanosomes by intraperitoneal injection.
D signifies death of animal.

to the time when trypanosomes appear, and the duration of life as compared with the controls, or whether the animals remain sterile for an indefinite period of time.

The influence of various well-known mercurial compounds and phenol upon T. equiperdum in this test is shown in Table XII.

The results demonstrate that these mercurial compounds are capable of exercising an influence upon trypanosomes, which effect is not apparent in tests *in vivo* due probably to the high toxicity of these compounds and the necessity of administering relatively small doses (Table XIII).

The results of tests with certain new mercurial compounds are shown in Tables XIV, XV and XVI.

The remarkably high trypanocidal activity of arsenobenzol in this test is shown in Tables XVII and XVIII.

In charts XV and XVI it is seen at a glance that the new mercuric compounds Nos. 99, 105 and 42, in which we are so much interested, are distinctly superior to bichloride of mercury in their trypanocidal effect by this method. There is much reason to believe that the effect exerted in this test is largely *in vitro*, but the determination of the results is obtained by an experiment *in vivo*.

The Effect of Mercury Compounds on T. Brucei and T. Lewisi. In the preceding charts the experiments with various mercurial compounds have been detailed in their effect on the T. equiperdum. We have also carried out a series of tests with various compounds on the T. brucei, the organism which causes Nagana disease of horses. Below is presented a chart (Table XIX) showing the maximum dose of the different compounds employed. Inasmuch as the highest dose used had no effect on the trypanosomes, it is unnecessary to give a detailed table of each experiment.

The T. equiperdum and the T. brucei are both microörganisms which kill infected animals within a short period of time. It was thought that we might possibly accomplish more with mercurials in the treatment of rats infected with the T. lewisi inasmuch as this organism is saprophytic in certain species of rats and does not, as a rule, kill the animal.

TABLE XII.—EFFECT OF MERCURIAL COMPOUNDS AND PHENOL UPON T. EQUIPERDUM IN THE COMBINED TEST IN VITRO–VIVO

	No.	Wt. in gms.	Dilutions	Amount in gms.	Results of daily examination of tail blood											
					1	2	3	4	5	6	7	8	9	10	11	12
Mercuric chloride	1	105	1 : 2500	.0004	–	–	–	D								
	2	160	1 : 5000	.0002	–	–	–	–	–	D						
	3	102	1 : 10000	.0001	–	–	–	–	Few	++	+++	++++	D			
	4	128	1 : 20000	.00005	–	–	–	–	–	–	–	–	Few	Few	+	+++
	5	100	1 : 40000	.000025	–	–	–	–	–	Few	+	++++	D			
Mercury salicylic acid	6	132	1 : 2500	.0004	–	–	–	D								
	7	102	1 : 5000	.0002	–	–	–	–	D							
	8	85	1 : 10000	.0001	–	D										
	9	94	1 : 20000	.00005	–	–	–	–	–	–	D					
	10	103	1 : 40000	.000025	–	–	–	–	–	–	–	–	–	–	–	Few
Calomel	11	100	1 : 2500	.0004	–	Few	Few	D								
	12	82	1 : 5000	.0002	–	–	+++	D								
	13	85	1 : 10000	.0001	Few	+	+++	D								
	14	89	1 : 20000	.00005	Few	+	+++	D								
	15	76	1 : 40000	.000025	Few	+	+++	D								
Phenol	16	100	1 : 100	.01	–	–	–	–	D							
	17	87	1 : 200	.005	–	–	–	–	–	–	–	–	+	+++	++++	D
	18	77	1 : 400	.0025	–	–	–	–	D							
	19	87	1 : 800	.00125	–	–	Few	++	++++	D						
	20	93	1 : 1600	.000625	Few	+	+++	++++	++++	D						
Controls	21	76	0	0	Few	+	++++	D								
	22	70	0	0	Few	+	++++	D								
	23	58	0	0	Few	+	++++	D								
	24	78	0	0	Few	+	++++	D								

TABLE XIII.—COMPARISON OF THE TRYPANOCIDAL ACTIVITY OF BICHLORIDE OF MERCURY IN THE VIVO AND THE COMBINED VITRO-VIVO METHODS*

Method	No.	Wt. in gms.	Dose	Results of examination of blood from tail														
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Routine in vivo	1	49	.0003**	+	++++	++++	D											
	2	66	.0002	+	++	++++	++++	++++	D									
	3	55	.0001	+	+	+++	++++	D										
	4	70	.00005	+	++	++++	D											
	5	80	Control	+	+++	++++	D											
	6	65	Control	+	+++	++++	D											
Combined vitro-vivo	7***	78	.0004****	—	—	—	D*****											
	8	70	.0002	—	—	—	—	—	—	Few	+	+++	++++	++++	D			
	9	95	.0001	—	—	—	—	—	—	Few	+	++	++++	D				
	10	95	.00005	—	—	—	—	Few	+	+	+++	++++	D					
	11	108	.000025	—	—	Few	Few	+	+	++	++++	D						
	12	90	Control	—	—	Few	+	++++	++++	++++	D							
	13	70	Control	—	—	Few	+	++++	++++	D								

* Rats infected by intraperitoneal injection with 120,000 T. equiperdum twenty-four hours before the intravenous administration of bichloride of mercury.
** Doses of bichloride of mercury per 100 grams of body weight.
*** Combined vitro-vivo method conducted with 120,000 T. equiperdum.
**** Amount of bichloride of mercury to which trypanosomes had been exposed for 15 minutes in vitro.
***** Probably death due to toxicity of mercury.

TABLE XIV.—EFFECT OF MERCURIAL COMPOUND UPON T. EQUIPERDUM IN THE COMBINED TEST IN VITRO–VIVO

Mercurial compounds	No.	Wt. in gms.	Dilutions	Amount in gms.	Results of daily examination of tail blood											
					1	2	3	4	5	6	7	8	9	10	11	12
Mercuric chloride	1	78	1 : 2500	.0004	–	–	–	D								
	2	70	1 : 5000	.0002	–	–	–	–	–	–	Few	+	+++	++++	++++	D
	3	95	1 : 10000	.0001	–	–	–	–	–	–	Few	+	++	++++	D	D
	4	95	1 : 20000	.00005	–	–	–	–	Few	+	+	+++	++++	++++		
	5	108	1 : 40000	.000025	–	–	Few	Few	+	+	++	++++	D			
No. 41	6	78	1 : 2500	.0004	–	–	–	–	–	–	–	–	Few	++	++	D
	7	92	1 : 5000	.0002	–	–	–	–	–	–	–	Few	+	+++	+++	D
	8	80	1 : 10000	.0001	–	–	–	–	D							
	9	97	1 : 20000	.00005	–	–	–	–	Few	Few	+	+++	++++	++++	++++	++++
	10	87	1 : 40000	.000025	–	–	Few	+	+	++	++++	++++	++++	D		
No. 2	11	101	1 : 2500	.0004	–	–	–	–	–	–	–	–	–	–	D	
	12	103	1 : 5000	.0002	–	–	–	–	–	–	–	–	–	–	D	–
	13	85	1 : 10000	.0001	–	–	–	–	–	–	–	–	–	–	–	–
	14	89	1 : 20000	.00005	–	–	–	–	–	–	–	–	–	–	–	
	15	90	1 : 40000	.000025	–	–	Few	+	+++	++++	D					
No. 4	16	78	1 : 2500	.0004	–	–	–	–	–	–	–	D				
	17	92	1 : 5000	.0002	–	–	–	–	–	–	Few	Few	Few	+	+++	D
	18	82	1 : 10000	.0001	–	–	–	–	–	Few	+	+++	++++	++++	D	
	19	115	1 : 20000	.00005	–	–	–	–	Few	+	++	+++	D			
	20	88	1 : 40000	.000025	–	–	Few	Few	+	++	++++	D				
Controls	21	83	0	0	–	–	Few	Few	+	++	++++	D				
	22	90	0	0	–	–	Few	+	++++	++++	++++	D				
	23	70	0	0	–	–	Few	+	++++	++++	D					
	24	80	0	0	–	–	Few	+	++++	++++	D					

TABLE XV.—EFFECT OF MERCURIALS UPON T. EQUIPERDUM IN THE COMBINED TEST IN VITRO–VIVO

Compound	No. of rat	Wt. in gms.	Dose	Results of daily examinations of blood from the tail															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mercury-nitrosalicylic acid	1	70	.001	–	–	D													
	2	112	.0005	–	–	D													
	3	115	.00025	–	–	–	+	++	++	+++	+++	++++	++++	D					
	4	105	.000125	–	–	–	–	–	–	–	+	++	++	+++	++++	++++	++++	D	
	5	70	.000062	–	–	–	–	–	–	–	+	++	++	+++	++++	D			
No. 105	6	80	.001	D															
	7	150	.0005	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	8	135	.00025	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	9	110	.000125	–	–	–	–	–	–	–	–	–	–	–	Few	+	++++	++++	D
	10	75	.000067	–	–	–	–	–	–	–	+	++	++++	++++	++++	++++	++++	D	
No. 42	11	77	.001	D															
	12	85	.0005	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	13	165	.00025	–	–	–	–	–	–	–	–	–	–	Few	+	++	++++	++++	D
	14	90	.000125	–	D														
	15	135	.000062	–	–	–	–	–	–	–	–	Few	+	++	++	+++	++++	D	
No. 99	16	103	.001	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	17	92	.0005	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	18	90	.00025	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	19	115	.000125	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	20	105	.000062	–	–	–	–	–	–	–	–	–	–	–	Few	+	++++	++++	D
Mercuric chloride	21	47	.001	–	D														
	22	97	.0005	–	–	–	–	–	–	–	–	–	–	–	–	D			
	23	115	.00025	–	–	+	+++	+++	++++	++++	++++	++++	++++	++++	++++	++++	++++	++++	++++
	24	65	.000125	–	–	+	++++	++	D										
	25	80	.000062	–	–	+	++	++	++	++	+++	++++	D						
	26	105	Control	–	–	+	++++	D											
	27	90	Control	–	–	+	D												
	28	120	Control	–	–	+	+++	D											

TABLE XVI.—EFFECT OF MERCURIAL COMPOUNDS UPON T. EQUIPERDUM IN THE COMBINED TEST IN VITRO–VIVO

Compound	No. of rat	Wt. in gms.	Dose	Results of daily examination of blood from the tail														
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
No. 39 Sulpho-β-naphthyl-amine mercuric acetate	1	113	.001	–	–	D													
	2	117	.0005	–	–	–	D												
	3	97	.00025	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	4	128	.000125	–	–	–	Few	+	++	++++	++++	++++	++++	D					
	5	150	.000062	–	+	+++	D												
No. 42 New mercury compound	6	112	.001	–	–	–	D												
	7	89	.0005	–	–	–	D												
	8	95	.00025	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	9	126	.000125	–	–	–	–	–	–	Few	+	++	++++	D					
	10	100	.000062	–	–	–	–	–	Few	+	+++	++++	++++	D					
	11	108	Control	–	++	++++	++++	++++	D										
	12	99	Control	–	++	++++	++++	++++	D										

TABLE XVII.—EFFECT OF BICHLORIDE OF MERCURY AND ARSENOBENZOL UPON T. EQUIPERDUM IN THE COMBINED TEST IN VITRO-VIVO

	No.	Wt. in gms.	Dilutions	Amount in gms.	Results of daily examination of tail blood													
					1	2	3	4	5	6	7	8	9	10	11	12	13	14
Bichloride of mercury	1	100	1 : 10000	.0001	—	—	—	—	D									
	2	102	1 : 15000	.000066	—	—	—	D										
	3	110	1 : 20000	.00005	—	—	—	—	Few	++	+++	D						
	4	115	1 : 30000	.000033	—	—	—	—	Few	+++	D							
	5	67	1 : 40000	.000025	—	—	—	Few	+++	++++	++++	++++	D					
	6	94	1 : 60000	.000016	—	—	—	Few	++	D								
	7	89	1 : 80000	.0000125	—	—	Few	+	D									
	8	85	1 : 120000	.0000083	—	—	Few	+	+++	D								
	9	90	1 : 160000	.0000062	—	+	++	+++	++++	D								
	10	102	1 : 240000	.00000416	—	—	Few	+	+++	D								
Arsenobenzol	11	91	1 : 400	.0025	—	—	—	—	—	—	—	—	—	—	D			
	12	80	1 : 600	.0015	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	13	55	1 : 800	.00125	—	—	—	—	—	—	D							
	14	71	1 : 1200	.00083	—	—	—	—	—	—	—	D						
	15	113	1 : 1600	.00062	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	16	89	1 : 2400	.00041	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	17	84	1 : 4800	.000208	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	18	105	1 : 9600	.000104	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	19	91	1 : 19200	.000052	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	20	88	1 : 40000	.000026	—	—	—	—	—	—	D							
Control	21	87	0	0	Few	+++	++++	D										
	22	93	0	0	—	—	Few	++	D									
	23	77	0	0	Few	+	++	+++	D									

TABLE XVIII.—EFFECT OF ARSENOBENZOL UPON T. EQUIPERDUM IN THE COMBINED TEST IN VITRO–VIVO

Number	Weight in gms.	Dilutions	Amount in gms.	Results of examination of tail blood in days											
				1	2	3	4	5	6	7	8	9	10	11	12
1	90	1 : 1000	.001	–	–	–	–	–	–	–	–	–	–	–	–
2	83	1 : 2000	.0005	–	–	–	–	–	–	–	–	D			
3	84	1 : 4000	.00025	–	–	–	–	–	–	–	–	–	–	–	–
4	72	1 : 8000	.000125	–	–	–	–	–	–	–	–	–	–	D	
5	110	1 : 16000	.0000625	–	–	–	–	–	–	–	–	–	–	–	–
6	80	Control	0	Few	Few	Few	+	++	++	D					
7	91	Control	0	–	–	–	Few	+++	D						
8	97	Control	0	–	Few	Few	+	+	+	++	++	D			
9	82	Control	0	–	Few	+	+++	++++	++++	D					

TABLE XIX.—INFLUENCE OF MERCURIAL COMPOUNDS ADMINISTERED INTRAVENOUSLY TWENTY-FOUR HOURS AFTER INFECTION WITH T. BRUCEI

Laboratory number of compound	Name of compound	Maximum dose per 100 gms.	Equivalent per 60 K. (125 lbs.)	Effect on trypanosomes
41	Hexamethylenetetramine-mercuric acetate	.0004	0.24	None
39	Sulpho-β-naphthylamine-mercuric acetate	.0005	0.3	None
34	Disulpho-β-naphtholmercuric oxide	.0005	0.3	None
42	New mercury compound	.0004	0.24	None
46	Pyridinemercuric acetate	.0003	0.18	None
35	Sulpho-benzidenemercuric acetate	.0004	0.24	None

TABLE XX.—INFLUENCE OF MERCURIAL COMPOUNDS ADMINISTERED INTRAVENOUSLY TWENTY-FOUR HOURS AFTER INFECTION WITH T. LEWISI

Laboratory number of compound	Name of compound	Maximum dose per 100 gms.	Equivalent per 60 K. (125 lbs.)	Effect on trypanosomes
3	Mercury-o-sulphamid benzoic acid	.0006	...	None
28	β-naphthylamine-azo-β-naphtholmercuric acetate	.006	...	Inhibition for 6 days
2	β-naphtholmercuric acetate	.0006	...	None
27	Amidobenzolsulpho-azo-β-naphthol-mercuric oxide	.0006	...	None

Below is given a summary of experiments carried out with four different mercurial compounds on the T. lewisi experimentally inoculated in white rats.

DISCUSSION

At the outset it might be advisable to discuss the justification of regarding the action of medicaments upon trypanosomes in the experimental animal as criteria of their influence upon the spirochete in human syphilis. While the exact biological status of the Spirocheta pallida has not been definitely fixed, the preponderance of scientific opinion is in favor of its being an animal parasite. Study of cultures of the sphirochete under dark-field illumination on a warmed stage enables one to detect reproduction by longitudinal fission, which is an attribute ascribed to animal organisms. The

parasite which we have, for the greater part, employed in our studies, is the T. equiperdum, the parasite of horse syphilis or "la dourine." This disease is contracted by horses through coitus and commonly leads to a fatal outcome with paralysis as a terminal symptom.

We have employed the spirochete of Obermeyer, the parasite of relapsing fever, in many of our tests and these organisms have been influenced by the same drugs that exerted an influence upon trypanosomes, and they have remained uninfluenced by the medicaments that were inert in their effect on trypanosomes.

Inorganic arsenic has no effect on experimental trypanosomiasis except in huge doses, and it has but a feeble effect upon the symptoms of human syphilis. Salvarsan has a remarkable sterilizing influence in experimental trypanosomiasis and effects a cure in the dose of 15 to 20 mg. per kilo of body weight. Salvarsan rapidly destroys the Spirocheta pallida in living tissues when it comes in contact with the same. The prompt disappearance of the parasites in the chancre and in mucus patches is evidence of this action.

This parallelism in the effect of remedies upon trypanosomes in the experimental animal and their effect upon human syphilis cannot, however, be carried too far. We believe that we are justified in anticipating that a remedy which will exert a powerfully destructive influence upon trypanosomes *in vivo* will exert a similar influence upon the spirochete of syphilis, but the converse of this proposition is not of necessity true.

The failure of a chemical substance to influence trypanosomiasis does not indicate that it will be equally inefficacious in its effect upon the spirochete of syphilis. It must be remembered that infection of the white rat with the T. equiperdum produces an acute virulent disease which destroys the life of the animal in from 4 to 7 days. Within 24 to 36 hours after intraperitoneal injection with the blood of an infected animal the trypanosomes appear in the circulating blood, increase in number from day to day, until before death there are more trypanosomes than there are erythrocytes. It is a severe test for a therapeutic agent, injected into the blood 24 hours after infection, to destroy the rapidly multiplying parasites. To accom-

plish this a massive sterilizing dose must be administered. This is only possible with drugs of low toxicity such a salvarsan. Mercury cannot be given in sufficient dose because of its greater organotropism and consequent poisonous effect upon vital centers. None of the mercurial compounds in common use are capable of destroying the trypanosomes nor of materially prolonging the life of the infected animal. Whether the failure of mercury to accomplish this result is due solely to its high toxicity or to lack of selective influence upon trypanosomes cannot be definitely stated.

Syphilis is a disease in which certain defensive agencies of the body are brought into operation. The invasion of the blood stream is gradual, and even after the spirochetic septicemia takes place (during the so-called secondary period), protective influences are at work which destroy many of the parasites lodged in the tissues. If this were not the case the chancre and the generalized eruptions would not disappear spontaneously as they commonly do. In some persons, particularly those in depraved health, the defensive bodies are weaker, and untreated, the early symptoms progress rapidly, and may lead to a fatal termination.

Syphilis ordinarily is a chronic disease and not an acute overwhelming infection such as is produced by the T. equiperdum or the T. brucei in the white rat. Mercury in syphilis therefore has a better opportunity, even in small doses, to exert an effect.

Several centuries of experience have taught us that mercury is a valuable drug in the treatment of syphilis.

From the foregoing the following propositions may be formulated:

(1) *The fact that a chemical substance is capable of destroying the T. equiperdum in experimentally infected animals is strong presumptive evidence of its ability to exert a favorable effect in syphilis.*

If this proposition is true, and we believe it to be so, this laboratory method constitutes an excellent criterion for the comparative study of new drugs. Of course the actual effect of a remedy in syphilis can only be determined by its influence upon the lesions and the parasites of experimental syphilis, and by its effect on human syphilis.

(2) *The failure of a chemical substance to destroy the parasites in experimental trypanosomiasis is of itself no proof that the medicament may not exert a favorable influence upon syphilis.*

Chicken spirillosis, due to infection with the Spirocheta gallinarum, appears to be less virulent disease than experimental trypanosomiasis (equiperdum) and European investigators have reported demonstrable effect upon these parasites by certain mercurial compounds.

THE EFFECT OF DRUGS IN VITRO AND THE INTERPRETATION OF THE RESULTS AS A THERAPEUTIC GUIDE IN THE TREATMENT OF EXPERIMENTAL INFECTIONS

By adding chemical substances in varying quantities to fluid cultures freshly inoculated with bacteria, one may determine the amount necessary to inhibit the growth of the organisms under consideration and ultimately destroy them. The *antiseptic* value of the chemical may be thus established. The germicidal value of the Rideal-Walker methods, which have been detailed elsewhere, may be determined by the U. S. Public Health Bureau.

Of the various medicaments which we have from time to time tested out on bacteria, none has hitherto equalled the bichloride of mercury and similar mercuric compounds. While the staphylococcus and the Bacillus typhosus are readily killed in the test-tube by mercuric chloride in great dilution, this drug will not destroy these bacteria in the living body.

This discrepancy may be due to three causes: the inability to administer a sufficiently large dose of mercury to animals without injurious and fatal effect on the body cells, the presence in the body fluids and cells of complex organic substances which may take up or change the mercury before it is permitted to attack the bacteria, and the lack of a specific affinity for the parasites.

Mercury is perhaps the best bactericide in the test-tube that is known, and yet no notable results appear to have been obtained in human bacterial diseases by its use.

The effect of a drug on bacteria *in vitro* is no sure guide as to its action on the same germs *in vivo*.

The destruction of bacteria in the test-tube is doubtless due to a biochemical union between the drug and the protoplasm of the organism, although some investigators argue that the action is brought about by absorption, which is a physical process. In either event the specificity of the action is governed by selective affinity. This brings us to a consideration of the following interesting query: *Has salvarsan a greater selective affinity for the spirochete of syphilis than mercury?*

Let us first examine the laboratory data bearing upon this question. From the experiments already detailed it is seen that salvarsan has an enormously greater destructive influence upon the Spirochete pallida in culture than has mercury. Mercuric chloride kills the spirochete according to an experiment carried out by us in the dilution of 1 to 100. Salvarsan destroys the spirochete in 1 to 10,000 to 1 to 100,000. We may therefore deduce that in the test-tube salvarsan has a greater affinity for the Spirocheta pallida than mercury.

As indicating that the parasiticide action is a selective one, we may refer to the fact that vegetable organisms such as the staphylococcus and the Bacillus typhosus are far more vulnerable to the action of mercury in the test-tube than to salvarsan, although the latter is not devoid of germicidal effect. Our experiments with mercury and salvarsan on trypanosomes *in vitro* demonstrate that salvarsan is distinctly more parasiticide than mercury. In general terms it may be stated that *in the test-tube salvarsan exhibits a greater affinity for animal parasites, and mercury a greater affinity for vegetable parasites.*

These laboratory results are rather in accord with clinical observation. While mercury doubtless for the reasons above referred to, has not yet been demonstrated to destroy vegetable parasites in the living subject, salvarsan has accomplished this result in several diseases of animal parasitic origin. One need only refer to relapsing fever, yaws, syphilis, the tertian type of malaria and experimental trypanosomiasis.

In vivo, it is true, the only disease in which mercury has achieved signal results is syphilis, a disease due presumably to an animal parasite.

Some writers have alleged good results with mercury in the treatment of leprosy, tuberculosis and pus infections, but these are not capable of scientific proof. The predilection of mercury for vegetable parasites *in vitro* suggests that when active mercurial compounds of sufficiently low toxicity are produced, such drugs may exert a curative influence in bacterial diseases.

Our test-tube experiments in the laboratory all point to a greater selective affinity of salvarsan for Spirocheta pallida than is possessed by mercury.

THE COMPARATIVE EFFECT OF MERCURY AND OF SALVARSAN IN EXPERIMENTAL TRYPANOSOMIASIS

From the tables set forth of the influence of mercuric chloride in experimental trypanosomiasis (T. equiperdum), it is seen that this substance has no demonstrable effect upon the parasites, even in sublethal doses. Mercury was administered intravenously by us also to animals infected with the spirochete of Obermeyer, the T. lewisi and the T. brucei, with the same negative influence. Salvarsan, on the other hand, in the dose of 15 to 20 mg. per kilo of body weight sterilizes animals infected with T. equiperdum and in adequate doses the other infections referred to. It might be argued that the difference in effect is merely owing to the fact that mercury on account of its toxicity cannot be administered in this dose. That the question goes beyond this is evidenced by the fact that doses of 3 to 6 mg. per kilo of salvarsan will keep the blood free of parasites for a number of days, whereas a similar dose of bichloride of mercury has no such inhibitory effect upon the multiplication of trypanosomes and their appearance in the blood. *The superiority of the influence of salvarsan over mercury in experimental trypanosomiasis is incontestable.* This fact is a confirmation of the thesis that salvarsan has a greater affinity for animal parasites in the living body than has mercury.

ON THE POSSIBILITY OF PRODUCING NEW AND SUPERIOR COMPOUNDS OF MERCURY

The fact that mercury has a favorable influence upon the course of syphilis is established by several centuries of experience. The value of the drug is lessened, however, by its relatively high toxicity, and perhaps also by the fact that the inorganic salts of mercury and the organic compounds generally employed, have not sufficient selective affinity for the spirochete of syphilis. Salvarsan is tolerated intravenously by rats in the dose of 100 mg. per kilo of body weight; the bichloride of mercury cannot be borne in doses above 2 mg. per kilo. It is seen therefore that mercuric chloride is 50 times as toxic as salvarsan. Salvarsan, moreover, has a greater selective influence on trypanosomes and spirochetes than has mercuric chloride in doses weight for weight.

In elaborating salvarsan Ehrlich used the sodium salt of arsanilic acid as the starting-point. Atoxyl has a greater trypanocidal effect than inorganic arsenic, but is markedly inferior to salvarsan. There is every reason to believe that new organic compounds of mercury can be produced which will have a greater destructive influence on parasites than inorganic mercury, such as mercuric chloride. We have indeed prepared several organic mercury compounds which far transcend mercuric chloride in their effect on bacteria, and are likewise superior to this drug in their effect upon trypanosomes. Compound No. 99, prepared in our laboratory kills the staphylococcus in the test-tube in a dilution of 1 to 5,000,000, whereas mercuric chloride accomplishes this result in 1 to 100,000. It is thus seen that in this test compound No. 99 is fifty times more bactericidal than mercuric chloride. We have also demonstrated by tests on animals that this new compound is of lower toxicity than mercuric chloride, although we are not prepared to give the exact figures until more numerous repetitions of the test have been carried out. Compound No. 99 contains less mercury than mercuric chloride. Its increased germicidal and trypanocidal properties are to be attributed to the particular constitution of the molecule.

Our experience in chemotherapy work persuades us to believe that Ehrlich's working hypothesis concerning the existence of chemoreceptors in parasites is correct. Ehrlich, for instance, regarded the presence of the hydroxyl (OH) and amino (NH^2) groups in salvarsan as of great importance. Experiments which we have carried out on the arsenical series incline us to the view that the amino radical in salvarsan is perhaps as important as the arsenical group; the former appears to be necessary to enable the medicament to fasten itself to the parasite; this suggests the presence in the latter of amino receptors. Mercury can doubtless be combined with chemical substances in such a manner as to increase its affinity for parasites, both animal and vegetable. To be sure fruitful work along these lines requires infinite patience and an enormous amount of experimentation. Even after an ideal therapeutic mercurial compound is prepared, it must be of relatively low toxicity in order to be of practical value. And after these vital considerations are fulfilled there are certain clinical desiderata which are of importance. The compound, if insoluble, cannot be injected intravenously, and intramuscular injections may be so painful as to render the product clinically ineligible. As a matter of fact, our compound No. 99 is so painful by intramuscular injection that its use by this method had to be abandoned. Fortunately it can be rendered soluble and used by intravenous infusion. It is being tried out by this method at the present time and if favorable results are obtained due publication of its value in syphilis will be later published. It appears to us quite possible that compounds of mercury may be produced which may possess curative influence in bacterial diseases, for the affinity of mercurials for bacteria in the test-tube is much greater than that of salvarsan.

CONCLUSIONS

1. The most valuable scheme for the determination of the bacterial properties of new compounds is by the correlated employment of the antiseptic and germicidal tests *in vitro* and by the use of the drug in experimentally infected animals.

2. The best method of determining the trypanocidal properties of new compounds is by the parasiticide test *in vitro*, the test *in vitro-vivo* and by the employment of the medicament in experimentally infected animals.

3. Our test *in vitro-vivo* has shown itself to be more delicate in the demonstration of the trypanocidal activity of chemical compounds than any other test. Animals infected with trypanosomes treated with mercuric chloride by this method were for the first time kept sterile for a number of days, thus demonstrating some trypanocidal effect exerted by mercury.

4. The fact that a chemical substance is strongly germicidal in the test-tube is no evidence that it will exert a demonstrable influence on the same organism in the living body. Such substances, however, are more promising for chemotherapeutic investigation than those which are inert.

5. Vegetable organisms such as the Staphylococcus aureus and the Bacillus typhosus are far more vulnerable to the action of mercury in the test-tube than to salvarsan. Indeed, mercury possesses stronger bactericidal properties in the test-tube than any chemical agent with which we have experimented.

6. Salvarsan, however, is not devoid of germicidal effect, as it kills the staphylococcus in the dilution of 1 to 2000 upon prolonged exposure.

7. Salvarsan, in our experiments, has shown itself to be by far the most powerful trypanocide in the test-tube known. By the method *in vitro-vivo* it destroys trypanosomes in dilution as high as 1 to 40,000. Bichloride of mercury shows markedly inferior values in this respect. The superiority of the influence of salvarsan over mercury in experimental trypanosomes is incontestable.

8. In the test-tube salvarsan exhibits a greater destructive influence on *animal parasites*, and mercury a greater destructive influence on *vegetable parasites*. Salvarsan is a powerful trypanocide and a feeble bactericide; mercury is a powerful bactericide and a relatively feeble trypanocide.

9. Trypanosomes and spirochetes appear to react chemotherapeutically in a similar manner. Medicaments which have

a destructive effect upon the former, likewise appear to exert a similar influence upon the latter.

10. There is strong presumptive evidence that chemical substances which are capable of destroying trypanosomes in the animal body, exert a favorable effect in syphilis.

11. The failure, however, of a chemical substance to destroy the parasites in experimental trypanosomiasis is, of itself, no proof that the medicament may not exert a favorable influence in syphilis.

12. Our laboratory experiments on trypanosomes and spirochetes point to a greater selective affinity of salvarsan for the Spirocheta pallida than is possessed by mercury.

13. Mercuric chloride has a much greater organotropic effect than salvarsan; in our experiments mercury was 50 times more toxic for white rats than salvarsan.

14. A group of new organic mercury compounds has been prepared by us which far transcend mercuric chloride in their bactericidal power in the test-tube. One new compound has shown itself to be over 30 times more powerful in this respect, both by the Rideal-Walker and the "antiseptic" test.

15. These new mercury compounds also exhibit a greater destructive influence upon trypanosomes than does mercuric chloride.

16. Some of these compounds have shown a lower toxity than mercuric chloride.

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FRACTURES TREATED AT THE AMERICAN AMBULANCE HOSPITAL[1]

By CHARLES F. MITCHELL, M.D.

When we consider that over 75 per cent. of the wounded admitted to the American Ambulance Hospital are suffering with fractures of one kind or another, it becomes quite evident that only the salient points can be considered in a brief *résumé* of the condition, treatment, and results in these cases.

To a large extent war surgery is a surgery of compound fractures and the various complications accompanying such injuries, such as infection, injuries of nerves, bloodvessels, muscles, etc.

In ordinary hospital practice we are accustomed to seeing a great many fractures, the majority of which are simple in character. The exact opposite, however, is true in a military hospital during war-time, for there we see only the compound and complicated variety, and the simple becomes a real curiosity.

The treatment of these fractures starts on the battlefield, then is taken up in the field hospital, and finally at the base hospital, the American Ambulance Hospital being one of the base hospitals.

In the field very little can be done other than first-aid treatment —that is, application of tourniquets in cases of hemorrhage, covering wounds with sterile dressings, etc., and the removing of the patient with all possible haste to the nearest field hospital. There the wounds are thoroughly cleansed, foreign bodies such as bits of shell, clothing, etc., removed, and suitable drainage established. Afterward the application of various forms of apparatus to immobilize the parts. Sometimes plaster of Paris is used for

[1] Read January 22, 1917.

immobilization, but now both in the French and the English field hospitals, splints of aluminum and metal frames of various kinds have taken the place to a large extent of the plaster and wooden splints.

Possibly the best splints for use at the front and also in the final treatment of the various forms of compound fracture are those suggested by Jones, of Liverpool, and described by him in a paper published in the *British Medical Journal*, January 16, 1915, which also contains pictures and descriptions of his various splints. No one can read his article and look at the cuts without feeling that they are the best, merely because they are the simplest that can be used, not only from their easy application, but from the undoubted comfort which they give.

In the early days of the war it was necessary to manufacture at the hospital all the splints and apparatus used, and a great many which were thought to be new were merely makeshifts of what had already been used for many years. As an example, the Thomas splint for the lower extremity, with which we are all familiar, was made and used on a majority of the leg cases, but now I believe modifications as suggested by Jones from samples he sent over are universally used in the wards.

I would lay special emphasis on the Thomas splint, or rather the modified Thomas splint, for use in fracture cases of the humerus. This splint appears as figure 7-A in Jones's article, and would be most useful in ordinary hospital and private practice in those cases of fracture of the middle and upper third with overlapping of the fragments which caused most of us so much trouble. The chief advantage of this splint is that it gives good support to the forearm, and a firm extension can be made on the lower fragment of the humerus.

Complete statistics from the American Ambulance Hospital are difficult to obtain, not because they have not kept up-to-date histories, for, as a matter of fact, the histories there will be found to be much better and much fuller in every respect than in the average hospital in this country, but along with the histories it is necessary to keep a number of reports for the Government,

which complicate the history-taking very much, and they are the cause at times of histories being sent to the wrong place, and if once so sent, they never return to their proper files.

From September 1, 1915, to September 1, 1916, there were admitted to Dr. Hutchinson's service 2000 cases. When I say to Dr. Hutchinson's service, I mean practically a little over half the service in the American Ambulance Hospital, the other service being under the direct charge of a former Philadelphian, Dr. De Bouchet. Of these 2000 cases 817 were carefully analyzed, but the remainder, 1183, due to a clerical error were lost track of. Of these 817 cases the total number of fractures were 673, making a percentage of over 82 per cent. of the total number of wounded suffering from fracture. Estimating on 2000 cases, we find that over 1528 of the 2000 were likewise fracture cases.

INJURIES OF JOINTS

	Shoulder.	Elbow.	Wrist.	Hand.	Hip.	Sacro-iliac.	Knee.	Ankle.
Penetrating	3	22	3	24	1	2	30	6
Disarticulation	3							
Dislocation	2							
Perforation	..	16	..	8	..	1	13	13
Total	8	38	3	32	1	3	43	19

Total, 147

FRACTURES

HEAD

Frontal	5
Parietal	1
Temporal	10
Occipital	2
Total	18

FACE

Nasal	7
Malar	3
Superior maxilla	21
Inferior maxilla	59
Palate	3
Total	93

CHEST

Sternum	2
Spine	3
Total	5

SHOULDER	
Scapula	22
Clavicle	7
Total	29
ARM	
Humerus, simple	1
Humerus, compound	137
Total	138
FOREARM	
Radius, simple	1
Radius, compound	33
Ulna, compound	28
Total	62
HAND	
Carpal	7
Metacarpal	7
Phalanges	6
Total	20
THIGH	
Femur, simple	2
Femur, compound	90
Total	92
LEG	
Tibia, simple	5
Tibia, compound	101
Fibula, simple	4
Fibula, compound	57
Patella, simple	2
Patella, compound	2
Total	171
FOOT	
Astragalus	3
Os calcis	2
Tarsal	6
Metatarsal	11
Phalanges	12
Total	34

Total number of fracture cases, 673.

Of the total number of fractures there were six simple fractures, and these are so rare that I think I might mention the history of three of them which came under my own personal observation. Two were fractures of the femur and one a chauffeur's fracture. One of the femur fractures was sustained by the individual, not while

fighting in the trenches or in charging through wire entanglements toward the enemy, but from a fall from a ladder while at work in an arsenal near the hospital. The second case came from really near the firing line, where the man was serving as a transport driver, and though he escaped from the bursting shells about him, he failed to avoid the vicious kick of the proverbial army mule. The case of the chauffeur's fracture was the result of the back-firing from that peace-advertised—but what has proved itself most valuable in ambulance work—Ford car.

In the foregoing table we did not include penetrating and perforating wounds of the various joints. The total number of these was 147 and an appended table will show the location of each. As to the number of operations performed on bones, there were 229 in all, 16 of which though on fracture cases were for empyema and mastoiditis and should be excluded, leaving 213 as a total number of fracture cases operated upon. This, of course, does not include incision and drainage cases, operations on nerves, amputations, etc., a large percentage of which were done in compound fracture cases. The total number of operations done during the year was 1005; this number, of course, is estimated on the analyses of the 817 histories.

OPERATIONS

BONES

Resection, rib	13
Excision, patella	1
Excision, femur, head	1
Excision, knee	1
Mastoidotomy	3
Grafting	30
Splinting wire:	
Insertion	16
Removal of	5
Lane plate:	
Insertion	7
Removal	1
Pahrym band:	
Insertion	4
Removal	1
Sequestrotomy	137
Steinman pin:	
Insertion	2
Removal	2
Multiple drilling	5
Total	229

It must be remembered that the cases admitted to the Ambulance are not recent cases in the greater majority of instances, usually the average time for what we called recent cases being a week after the injury. In the spring and summer time, when the fighting was more active, and also when the firing line was nearer, much more recent cases were received. This delay was due often to the condition of the patient which would not warrant earlier transportation, or that facilities for moving the wounded were delayed for various reasons.

Upon admission to the hospital the patient first of all is bathed. The next step was to make sure that free drainage was present. If not, the patient was anesthetized and suitable drainage established. In cases complicated by gas gangrene or gas infection the parts were laid open freely, as this proved to be the only satisfactory form of treatment. Amputation at first was used in a certain number of these gas cases, but it was found that if free incisions laying well open the infected area did not suffice, amputation did not avail. After the patient was placed in bed, whether the fracture was of the upper or the lower extremity, it was usually suspended from an overhead frame, which has been called the Balkan frame, having received its name from its use during the Balkan War. However, I think this frame was used many years before; and I know at the Pennsylvania Hospital we used the one bar instead of the two for suspension purposes long before the Balkan wars were thought of.

X-rays were taken as soon as the patient's condition warranted the necessary moving and a series of these pictures were taken from time to time until he is discharged from the hospital.

It is impossible to go into detail regarding all the fractures encountered, and I will not try to even mention the various surgical procedures undertaken for their relief, as these subjects have been taken up by other speakers. The fractures of the upper extremity consisted of 137 compounds and one simple fracture of the humerus; 33 compounds and one simple of the radium, and 25 compounds of the ulna. Those of the forearm need little mention, as they could be treated either on a Palmer splint or a posterior

splint, or the dorsal flexed wrist splint, etc., as the position of the wound made necessary; or where extension was advisable they were suspended from the overhead frame. In the fractures of the humerus, however, whether it was at the elbow, head or the shaft of the bone, these were invariably treated at first by means of the overhead frame, already spoken of. A Buck extension was applied to the forearm, and if necessary, also to the lower fragment of the humerus, so that the arm was suspended from above, and traction made in any direction on the lower fragment of the humerus. This made it possible to dress the wounds of the arm and shoulder, keeping up the extension and suspension constantly during such procedure, and thereby causing the patient a minimum amount of pain.

In cases where the shoulder-joint was opened by the missile, we found that the French surgeons at the front were very fond of removing the head and a considerable portion of the shaft of the humerus, sometimes to an extent of four or five inches, thereby getting, as they expressed it "very free drainage," but they added greatly to the difficulty of obtaining a useful limb when suppuration had ceased. A flail joint usually was the result.

This also was true in cases of wounds about the hip-joint, and as an example of this, I might relate an instance of a man who was brought to the hospital about two months after his injury. He had a large suppurating wound of the right thigh, and the *x*-rays showed the head with about six inches of the femur removed. This man had been called to the colors from the beautiful Western city of Oakland, California, where he had held for a number of years the exalted position of head bar-keeper, and no doubt many times he has wished himself behind the distant bar in Oakland rather than in a cot at the American Ambulance Hospital. His condition was so desperate and the least movement gave him so much pain that it was with great difficulty that we were able to apply any sort of apparatus to hold his limb still, and make it possible to dress his wound. Buck's extension was applied and his leg placed in a Thomas splint and swung from the overhead frame which apparently gave him immediate relief. The comfort derived from

this form of dressing, in this particular case, made such an impression upon me that I think it worth mentioning as a good illustration of the use of this form of apparatus.

In fracture cases of the upper extremity, when the patients are able to get up, many of them sit in chairs by the side of the bed, with their extension and suspension still attached, and have perfect freedom and no pain on account of the movability of the suspension and extension. Later on, these arm cases, particularly those of the humerus and shoulder, are dressed in a frame or splint, which I believe was first suggested by Dr. Osgood, but which now is generally spoken of as the "aeroplane splint." The medical profession no doubt will see these splints advertised in the journals of today, and vaunted as the idea of one of the former residents of the hospital, who really had nothing to do with the designing of this most useful apparatus. These splints have already been described so often that I will not give a description here, but will show you later, on the screen, pictures of them and the methods of use.

In cases of fracture of the hip, thigh or leg, the limb was placed in a Thomas splint, applied either anteriorally or posterially to the limb, usually the latter, and suspended from the overhead frame. The Thomas splint as modified by Jones and called by him an "abduction frame" seems to me the best possible apparatus that can be used either at the front, enroute, or at the base hospital, for any injury of the lower extremity. This splint makes it possible to carry the patient by means of the splint itself, also keeps the limb absolutely still and in the best possible position for dressing and future healing of the fracture. In cases of the leg, foot or ankle, Jones advises the old Thomas knee splint as the simplest and most effective, but occasionally we found the use of the old standby, the fracture-box, the best form of treatment.

One word about certain forms of treatment of the wounds and the operations performed in cases of fracture. In the early days the use of bichloride, carbolic, Wright's Javelle, Dakin's, Labarraque's Solution, etc., all seemed to bring about the same results. However, it now is the general opinion that the use of Dakin's

solution under the technic as advised by Carrell, give the best results, and it is being used at present at the American Ambulance Hospital as a routine in all infection. A rule at the hospital was that in all operations on compound fractures, no pieces of bone which had any periosteal attachment were to be removed, and Jones goes further than this and advises that no bone be removed, even the loose fragments being allowed to remain, and if soiled, they are to be removed, thoroughly cleansed, and replaced in the wound with the hope that some osteoblasts still remain and that bone may regenerate from this.

Extension was usually applied by means of Buck's extension apparatus—in a few instances the Steinman pins were used, but personally I never could see the advantage of using any apparatus which made even the slightest puncture of the skin, thereby giving one more foci for infection which needed so very little encouragement to spread. There is also the possibility of producing necrosis, which condition I must say I have never heard of following the use of these pains. Plaster-of-Paris dressings were used a great deal both at the front and in the base hospitals. Some of the units that preceded the Pennsylvania used them with very good results, but personally I think plaster of Paris is not so applicable in the treatment of these cases as the frame and splints, except when applied by an expert in its use. Jones advises against the use of plaster at the front and says: "Despite every precaution for the exposure of the wound, the plaster mops up discharges like blotting-paper, and becomes horribly offensive, thereby adding greatly to the infection of the wound."

The complicated variety of fractures encountered consisted of injuries to the nerves, joints, loss of muscle, large area of skin, etc. I cannot omit a word about the fractures of the bones of the head, particularly those of the upper and lower jaw and the wonderful work done by the Dental Department in charge of Dr. Hayes and Dr. Davenport. A full report of these cases has been published from time to time in the Dental Journals of the country, and the work done by these men and their associates certainly does credit to the ingenuity and painstaking character of the American dentist.

In conclusion, the treatment of compound fractures consists (1) in careful sterilization of the wound; (2) application of splints, frames, etc., which make possible the easy caring for the wounds, both from the stand-point of the patient and the surgeon, and (3) operations, such as bone-grafting, wiring, plating, etc., which should, in my opinion, only be performed after nature has been given a thorough opportunity to cure the condition herself, and then only in specially selected cases.

The briefest summary of the treatment of compound fractures to my mind, can be expressed by one word—"Conservatism."

To digress for a moment from the subject of this paper, I want to say that to a very large extent the reorganization and the efficiency, both of the management and the treatment of the wounded at the A. A. H., have been made possible by the untiring efforts of our Fellow Dr. James P. Hutchinson. He is undoubtedly the right man in the right place and this is demonstrated by his attitude to all his fellow-workers asking them for suggestions and always looking for some way to improve the methods already in use in every branch of the hospital work.

A REPORT OF THE YEAR'S WORK OF THE AMBULANCE OF THE AMERICAN HOSPITAL AT NEUILLY, FRANCE[1]

By WALTER ESTELL LEE, M.D.

Many of the changes in the work of the last year at the Ambulance have been made possible by Dr. Hutchinson's solution of one of the most difficult problems of administration. The demoralizing extremes in the rate of admission of patients, with a maximum of over 100 in twenty-four hours and a minimum of less than 50 in two months, required an unusual organization of the personnel and presented unique conditions of hospital management.

The first plan of evacuating our uncompleted cases to the South of France—when the pressure for beds exceeded our normal rate of discharge—was very unsatisfactory, and to overcome this Dr. Hutchinson developed the present system of convalescent homes, auxiliary hospitals, financed and nursed by the various French Red Cross organizations, but under the surgical supervision of the surgeons of the American Ambulance. In September there were some 1500 such convalescent or auxiliary beds, with 575 active or operative beds in the main hospital. Although during these last twelve months, from September 1, 1915, to September 1, 1916, the Ambulance has been compelled to act as a field hospital for months at a time and provide surgical care for the freshly wounded during the battles of Verdun and the Somme—this plan of Dr. Hutchinson's has made it possible to keep the

[1] Read January 22, 1917.

uncompleted cases of reconstructive surgery in these auxiliary beds during the periods of pressure—and then after the battle, when formerly there were depressing periods of inactivity, these cases were readmitted to the main hospital and there received the necessary surgery. Thus the patients received all the reconstructive surgery it was possible for us to provide, the Ambulance was saved the unjust criticism of an end-result for which they may have been only partially responsible, while the surgeons were given an opportunity of completing the work in an unusually large number of cases requiring plastic surgery of the face, nerves, bones, and joints.

These statistics presented are entirely from the service of Dr. Hutchinson, which includes over 300 active operating and more than 1000 convalescent beds. Time did not permit of an analysis of the work of the other half of the hospital, the service of Dr. DeBouchet.

Almost 2000 cases passed through Service B during this last year—exactly 1982. These patients had nearly 4000 surgical conditions requiring treatment, 3943, thus averaging two wounds per patient. There were 1319 major operations. The mortality for 1916 was 1.9 per cent. The mortality in 1915 of the entire hospital was 4.3 per cent. Very little credit for this decrease in mortality is due to the American Ambulance but rather to changes in the sanitary corps of the French Army. By establishing fully equipped hospitals near the firing line it was possible during 1916 to have the wounded men operated upon on an average of six hours after the receipt of their wounds, while in 1915 there was often a delay of six to ten days. This early operation with the removal of the foreign bodies, missiles, and clothing, and thorough surgical cleansing of the wound after the technic of Carrel has decreased the incidence of secondary hemorrhage, made clinical gas gangrene the exception instead of the rule, and so diminished the virulence of the infection that the open wounds now are far cleaner than those we are accustomed to see in civil surgery in America.

97.4 per cent. of our wounds were the direct result of missiles. At the present time practically all of the foreign bodies are removed

in the hospitals near the front. Of our 3763 wounds made by missiles it was only necessary for us to operate and remove foreign bodies in 177. Localization by the Marion apparatus, calipers and fluoroscope, the electric vibrator and telephone were so accurate that it was possible to remove 63.5 per cent. under local anesthesia.

The modern jacketed bullet is the most humane of the missiles, but unfortunately they form but a small proportion 27.5 per cent. and as the war has progressed this proportion has decreased. Thus

	Bullets.	Eclat.
1915	53.5	46.5
1916	10.5	89.5

In *bullet wounds* there is a minimum mechanical destruction of the tissues and frequently there is no infection carried in by the missile. With the wounds caused by *eclat* there is a maximum mechanical destruction of tissues and infection is always carried in. The treatment of these infected wounds has been a subject of much discussion and experimentation.

That at the primary operation all foreign bodies, missiles, clothing, and detached tissues should be removed, no one disputes at the present time.

The removal of fragments of bone with periosteal attachments is never practised now, though it was a matter of routine in the early days.

The end-results of complete excision of the comminuted portions of fracture of long bones are now seen everywhere and the lesson is so obvious that it permits of no discussion.

The organisms constantly found in these wounds are tetanus, Bacillus aërogenes capsulatus, streptococcus, pneumococcus, staphylococcus, pyocyaneous, and Gram-positive spore bearers.

Tetanus has been controlled by the use of preventive injections of antitetanic serum. In our last 2000 patients we had but 2 cases of tetanus.

Gas infection with its terminal gangrene is one of the unusual problems presented to the civil surgeon. Clinically we find the experimental work of Taylor in the laboratory of the Ambulance offers an explanation of the pathology of this process and a rational

and satisfactory method of treatment. The organism develops in the muscle tissues and generates an inert, non-toxic gas. This gas collecting within the muscle sheaths and fascial planes creates a pressure or tension which is followed by anemia and death of the muscle cells. The absorption of the highly toxic by-products of the autolyzed necrotic muscles tissue is the direct cause of death. The treatment then should not only be directed to the excision of the macroscopic necrosed tissues but also to a thorough splitting of the muscle sheaths and fascial planes for considerable distances beyond the wound. It has been our experience, that if such a surgical procedure, thoroughly done, does not arrest the progress of the infection, nothing else will avail and amputation is useless.

Those who have personally seen the work of Carrel unanimously agree that there should be a change in our attitude toward the treatment of *infected wounds*, and we must realize that it is possible to render infected wounds sterile long before it is accomplished by the usual and natural process of granulation.

Not only has Carrel accomplished all he claims but Depage at Le Panne has obtained as good if not better results.

Carrel claims that:

1. If he receives the patient within three hours after the injury he can in a large proportion of cases, by wide excision of the infected area and sterilization with Dakin's solution, safely employ immediate suture.

2. After an interval of three hours immediate suture is rarely employed. Excision of the infected tissue and subsequent constant seepage with the hypochlorite solution of Dakin is followed, and after three or four days, rarely more than seven, except when tendon sheaths, bones, or joints are involved, the wound will be surgically clean and secondary suture is safe. He reports but 4 per cent. of failure in 225 cases.

3. In wounds involving the bones he reports complete closure of 72 per cent. under thirty days. At the Ambulance we have not been able to obtain the uniform results one sees at Compiègne and Le Panne, but we have sutured wounds of the soft parts after six to ten days and closed compound fractures of the extremities after

ten, fifteen, and twenty days of treatment. From the personal criticism of Dr. Carrel, who tried in every way to aid us, we gradually grasped a few of the essentials of the technic.

1. That the treatment of infected wounds requires, in addition to the application of an antiseptic, the same degree and detail in surgical asepsis as we are accustomed to use in abdominal surgery. At Le Panne there is an operating room at the end of each ward where the daily dressings are done.

2. At the primary operation Carrel excises the actual and potentially infected tissues and to us this has seemed a very important factor in the end-results.

3. The solution of the hypochlorite must be of a definite and exact strength. No less than 0.45 per cent., because when weaker it is but slightly germicidal and no stronger than 0.5 per cent., for it then becomes very irritating. We have committed both of these errors and can testify to the disappointing results.

Finally, the end-results have an absolute relation to the metriculous care one gives to the detail of the primary operation, the preparation of the solution, and the mechanics of its instillation.

For the most complete report of the technic which has appeared in English literature I refer you to the recent contribution of Lyle in the *Journal of the American Medical Association*. This exactly follows the text of the monograph of Daufresne.

Primary Operation. Painting of the operative field with tincture of iodine, or better, thorough scrubbing with soap and water. Excision of all necrotic and bruised tissues with a sharp knife. Then with clean instruments the wound is laid wide open for exploration, obliteration of pockets, and removal of all foreign bodies, sources of infection, and infected tissues. The tract of the projectile is always methodically resected. Perfect hemostatsis should be accomplished because muscle tissue infiltrated with blood is difficult to disinfect and further, owing to the hemolytic property of Dakin's solution it has the power of dissolving blood clot and incomplete hemostasis invites secondary hemorrhage. Counter-openings are to be avoided whenever possible. The object is to keep the liquid in contact with all the surfaces of the wound,

keep the stopper in the tub and allow the antiseptic solution to sterilize the surfaces of the wound and there will be nothing to drain.

The solution is carried to the wound surfaces by small rubber tubes or catheters which are closed, by tying their distal ends, and have from one to ten small holes of 1 mm. diameter along their lateral walls.

Superficial Wounds. A thin layer of gauze is placed over the surface of the wound and the requisite number of tubes laid upon this gauze. This is to prevent encrustation and blocking of the holes with granulations.

Penetrating Wounds. For the simple type of wounds a single tube with enough lateral holes to spray the entire track is used and the solution then wells up from the bottom and escapes along the sides of the catheter. If the tract be large and terminate in a cavity with irregular and collapsible walls a small wick of gauze is introduced alongside of the tube to support the walls of the cavity and allow a thorough penetration of the fluid to all surfaces.

Through-and-through Wounds. The same type of perforated tubes are used, the distal tied end being passed from the lower wound to just beneath the upper wound. It should not pass through the upper wound nor allow the solution to escape from that portion of the tract. After the tubes are placed every portion of the surrounding skin which will come in contact with the light gauze dressing, which eventually becomes moistened with the Dakin solution, is covered with a previously prepared sterile strip of gauze, 2 to 4 inches wide, impregnated with vaselin. This is absolutely necessary in order to protect the skin from the irritation of the Dakin solution.

After-care. A strict instrumental technic must be employed and gloved hands must never come in contact with dressings or wounds. Instillation of the fluid is made every two hours by releasing the controlling Mohr pinch-cock. Ten cubic centimeters is the average quantity required or 150 c.c. in twenty-four hours.

The hydraulic system should be tested out at least once a day, because the displacement of the tubes and clogging of the orifices are frequently the causes of unsuccessful results.

Bacteriological Control. The bacteriological control of the course of the wound consists of the regular determination of the microbic content on the surface of the wound by transferring with a standard loop to a slide a portion of the secretion from the least promising aspect of the wound and counting the number of organisms per microscopic field ($\frac{1}{12}$ immersion oil lens). Ten fields are counted and the total is placed upon a chart. These counts are made every second day, and when for three successive counts or six days the microörganisms total one in ten fields or less the wound is considered sterile and it may be closed.

Resuture of Wounds. The surrounding skin and entire surface of the wound is carefully scrubbed with soap and water and then flushed with Dakin's solution. The encircling edge of the wound is then excised $\frac{3}{8}$ inch on the skin side and an equal distance upon the granulating surface, and when mechanically possible the wound is then closed by layer sutures without drainage. To extensive wounds which it is mechanically impossible suture tension may be applied to their edges by a lacing dressing. Upon the opposing edges are pasted canton flannel strips containing a row of shoe hooks, and by lacing these hooks with rubber bands constant tension is obtained.

Wound Healing. The wounds treated by the Carrel technic are entirely different from those treated by ordinary methods. They have strikingly bright red granulation, a minimum amount of secretion which is not opaque. There is no odor. Redness, tenderness, or induration of the skin edges is usually absent.

To what extent the end-results of the Carrel technic depends upon the hypochlorite solution, Dr. Hutchinson does not at the present time feel convinced. Our experiments with all the usual antiseptics were unfortunately made before we followed the careful technic of the present time. Special groups of cases are now being tried with different solutions with the Carrel technic.

Sir Almroth Wright has maintained that by using saline dressings of different strengths it is possible to bring the albuminous bactericidal substances from the tissues into the wound because of certain physical and physiological laws. The slight germicidal properties of salt solution, though admitted, does not deserve serious consideration. Wright himself has abandoned the theory of the physiological phenomena and from the experimental work of Taylor at the laboratory of the Ambulance at Ris Oranges one cannot but be convinced that Wright has misinterpreted the physical laws of osmosis in his theory. Clinically we have used saline dressings after the method suggested by Wright and have not been able to obtain the result he claims.

The saprophytic bacterial flora persisted quite as long as with the usual methods of antiseptic treatment and the separation of slough did not appear to be materially hastened.

Edema of the tissues around the wounds seems to occur more frequently after the use of hypertonic solutions of saline than with other solutions, possibly as a result of an increased deposit of salt.

The reparative reaction in the tissues seemed to be retarded.

Secondary Hemorrhage. Of course in a base hospital one rarely meets with primary hemorrhage but that it does occur and that surgeons at the front are alive to the possibilities of its treatment was shown by men coming to the rear who had had subclavian, brachial, popliteal and posterior tibial arteries ligated.

We found secondary hemorrhage frequently resulting from foreign bodies which had not been removed: delayed rupture of injured vessels or displacement of an occluding clot were also occasionally facts but infection and particularly infection with the gas bacillus was the cause of the greatest number of our secondary hemorrhages.

The routine treatment at the present time is first preventive by removing promptly all foreign bodies near great vessels. The first bleeding is often controlled by direct pressure but our experience has shown that the third hemorrhage indicated that pressure was inadequate and that the best results followed ligation, in healthy tissue of the proximal portion of the main vessel.

From our experience we feel that the points of election for ligation of the main vessel were:

Face	External carotid
Arm	Third portion of axillary
Forearm	Upper third of arm above origin of anastomotica magna
Hand	Pressure
Foot	Pressure
Leg	Lower portion femoral artery in Scarpa triangle
Knee	Superficial femoral below origin of profunda femoris
Middle thigh	If cannot find source of bleeding, common femoral

Total ligation of great vessels	38
Facial	2
Posterior tibial	2
Popliteal	4
Carotid—external	6
internal	1
Gluteal	1
Lingual	1
Femoral—common	6
superficial	8
Brachial	8

Injuries to Bones. 82 per cent. of our cases had compound fractures of the bones. Dr. Mitchell is to report in detail upon this phase of the work.

Injuries to the Joints. There were 147 such wounds. There has been a decided improvement in the end-result of injuries to the joints during the last year. The former conservative method of waiting for the symptoms of infection to appear and then draining with multiple tubes was very unsatisfactory. At present perforating wounds of the joints, in which the wounds of entrance and exit are closed and where there is no injury to the bones, should be immobilized and watched. If an effusion occurs and persists for several days it is aspirated and then if the infection progresses an arthrotomy is performed. The usual U-incision with transverse division of the patellar ligament 1 cm. below the patella. The open joint is then treated with Dakin's fluid.

Penetrating Wounds. Radical operations for injuries of the joints is now routinely practised in the field hospitals. Opening of the joints, excision of all bruised tissues, removal of foreign bodies, and after flushing the joint with Dakin's fluid the wounds are closed, leaving a small rubber drainage tube between the surfaces of the bones for twenty-four hours. Dr. Depage reports

perfect results in 86.36 per cent. of a group of 22 cases and in but 4.54 per cent. did the infection progress and make it necessary to finally resect the ends of the bones.

Amputations. Excluding the removal of fingers and toes there were only 46 amputations of the extremities in this group of 2000 cases. The present attitude of conservation of the limbs is to be commended, but as one sees more and more of these extensive suppurating wounds of the extremities the question arises whether in saving an extremity we do not frequently loose the life of the patient because of the long period of suppuration he must pass through; and it is quite frequent to have deaths resulting from a terminal infection in these suppurating wounds. Hemorrhage and infection were the two main indications for amputation. After practising ligation of the main arteries we were never required to amputate for hemorrhage. The Carrel technic by shortening the period of suppuration has certainly decreased the number of amputations for infection. It was rarely possible to perform a classical amputation because of the critical condition of the patients and circular or chop amputations were the rule. Frequently a perfect stump could be obtained from a circular amputation by placing a double Buck's extension upon the tissues. When this was unsuccessful reamputation could be practised. There were 22 reamputations.

THE ORTHOPEDIC PHASES OF MILITARY SURGERY[1]

By ROBERT B. OSGOOD, M.D.
BOSTON, MASS.

I FEEL somewhat apologetic in attempting to present to you the orthopedic phases of military surgery, considering the fact that the opinions which I have to offer are based on a short service of three months. It seems as if I had already written and talked quite as much as this experience warrants. I am, however, none the less grateful to you for this opportunity.

Germany was the first nation to organize an orthopedic base, in Munich, under Prof. Lange, who not many years ago made so many friends in America. His writings early in the war showed a keen appreciation of the problems, and suggested a carefully worked out, comprehensive scheme for solving them.

In England soon after the war began, Colonel Robert Jones, of Liverpool, was placed in charge of a base hospital at Alder Hey and given general supervision of the orthopedic surgery of the English Army. The necessities for this service have so increased that he has been obliged to establish other base hospitals at Brighton, Cardiff, Leeds, Aberdeen, Glasgow, Edinburgh, and Bristol, and is now eager to obtain the services of American orthopedic surgeons to help him meet the still increasing demands.

Recently the Canadian Government has become convinced that special attention must be given to this phase of surgery and has sent Dr. Clarence Starr, of Toronto, to organize a service for the expeditionary force of the dominion in England and France, giving Dr. W. E. Gallie charge of a large base hospital of deformities in Toronto, and placing Colonel A. Mackenzie Forbes, another able

[1] Read January 22, 1917.

orthopedic surgeon, in charge of the returning wounded in Montreal.

In France also the problem of the cripple is forcing attention to preventive measures. At the American Ambulance, Dr. Joseph Blake began the organization of convalescent homes, where consistent and continued after-treatment of deformities could be carried out by means of mechanotherapy, massage, and apparatus, to the end of the reëstablishment of the efficiency in the shortest possible time. You all know how splendidly Dr. James Hutchinson has enlarged and improved this organization. We believe that methods for the prevention of deformity and crippling should be adopted in every base and general hospital and applied as soon as the need can be anticipated.

It was impressive to find at the American Ambulance in a general surgical service taken over by a new group of surgeons interested in orthopedic surgery that fully 25 per cent. of the cases needed some definite preventive or corrective measure to ensure an end-result entailing the least possible crippling.

Fresh Injuries to Soft Parts. One of the groups which offered an opportunity for specialized treatment comprised the fresh injuries to the soft parts. Not a few internal derangements of joints occurred as a result of the wrenches and falls which are invited by trench and camp life. A slipping or fractured semilunar cartilage, a ruptured crucial ligament, a torn supraspinatus tendon, may be a truly crippling injury if it is neglected, but is usually completely amenable to appropriate treatment.

In the repair of wounds of muscular tissue there takes place sometimes quite suddenly, a very rapid and persistent contraction. In the calf, for example, this induces a deforming equinus of the foot; in the knee an obstinate flexion. These conditions, when once they occur, are often not to be relieved except by subsequent operation or a treatment entailing a prolonged convalescence. They are entirely preventable by the application of simple retentive splints worn during the healing process.

Paresis amounting to paralysis often ensues after nerve injuries, which do not result in a complete solution of continuity of all the

fibers. An apparatus which corrects the deformity, for example, a wrist-drop in a lesion of the musculospiral, not only opposes the gradual contraction of the antagonistic functioning flexors, but makes possible a more rapid return of power otherwise inhibited by the overstretching of the paretic group.

The wounds of the joints interested us greatly, and our respect for the resistance of joint tissues to infection steadily increased. From the outset of the service a policy of conservative treatment was followed, with no cause for regretting the adoption of the general principle, only an occasional necessity for rare radical procedures, and (so far as we know) with no disasters. If there was an opening into a joint of considerable size the joint was thoroughly washed out with normal saline or weak antiseptic solution, and either sewed up tight or only a small rubber tissue drain inserted. This was withdrawn in a few days, the external wound being kept freely open down to the capsule and the limb completely immobilized. We shall all agree that we would report with no little surprise a widely open drained joint which recovered with useful motion. We may expect, with no little confidence, a cleaned and closed joint to resist all but the severest infections, and to regain perfect function. This experience is in keeping with the series of cases reported by Lockwood.[1] The experiences of Berard and Barjaval[2] in France, of Haberer[3] in Germany and of Cotton in this country.

Simple Fractures Near Joints. In a second small group of cases of simple fractures in the neighborhood of joints we found much variation in the position in which the part had been immobilized. Yet much importance attaches to the position in which a joint fracture is allowed to unite. A foot allowed to become fixed in equinus, a knee in extreme flexion, a hip in adduction, a wrist dropped, a straight elbow, a shoulder which is not abducted is a severe handicap and an entirely preventable one. On the other hand, a rigid foot at a right angle, a stiff knee in a few degrees of flexion, an ankylosed, straight, slightly abducted, and outwardly

[1] British Med. Jour., January 29, 1916.
[2] Presse Médicale, October 7, 1915.
[3] Med. Klinik, February 14, 1915.

rotated hip, a wrist fixed in extension, an elbow without motion flexed to a right angle or a little beyond, an arm in which there is bony union between the head of the humerus and the scapula, but which forms an angle at 45 degrees with the body, is surprisingly useful, and often less crippling for laboring purposes than an imperfect joint with limited motion.

Compound Fractures Near Joints. When we consider the very large group of compound fractures, especially those involving joints, this immobilization position becomes still more important, since the likelihood of ankylosis becomes greater. The experience which we had, although admittedly short and inconclusive, left the strong impression that conservative measures adopted in these compound joint injuries might be expected to result in an eventual function, more perfect in degree than that which early radical excision usually secures, and quite as quick of attainment. The principles of bone repair have not yet been fully learned and cannot always be perfectly applied, since the laws which underlie them are not yet fully understood. Under these conditions an assisted Nature often gains a more perfect result than an overzealous art.

The methods of immobilization of these compound fractures have been most adequately discussed and need little further comment. We were convinced, *a priori*, that metal splints of some sort would furnish the most efficient form of fixation. We took over certain adjustable splints and devised others in practice.

Most English and American surgeons are still convinced that in combination with the overhead bed frames furnishing opportunity for traction and suspension in any plane, their obvious advantages make them most practical for general use. We are not disposed to dispute their claim, but we wish to point out the alternative possibility of employing plaster-of-Paris bandages with reinforced bridges spanning the wounds and allowing, if necessary, even constant irrigation. Germany has immobilized with plaster since the war began, and Stoeger,[1] Lange,[2] Goebel,[3] Hackenbruch,[4]

[1] München. med. Wchnschr., February 2, 1915.
[2] Ibid. [3] Ibid., August 3, 1915. [4] Med. Klinik, January 17, 1915.

Grasser,[1] have all maintained its applicability. Tuffier, in Paris, become satisfied that certain apparently hopeless limbs could be conserved by its use, and gradually in France, more than in England, it has grown in favor, as the articles of Fayerweather,[2] Manson,[3] Sénéchal,[4] Aubert,[5] and Lance[6] show.

These bulky plaster splints cannot always be as advantageously employed as metal splints, but starting with a prejudice against the use of plaster-of-Paris bandages in immobilizing these septic compound fractures, our short experience has led us to believe that they may often be the method of choice. They have certain supposed and some real disadvantages. They are said to be difficult and time-consuming to apply. Not if one takes the time to acquire a very simple technic, and if properly applied they need little subsequent adjustment. They may soon become soiled by excretions, not if they are properly protected. They are believed to be dangerous when secondary hemorrhage is threatened. Not in our experience if the danger is anticipated, and a tourniquet which can be quickly tightened is left in place above the wound.

Neighboring joints covered by them may become infected or abscesses form from unnoticed small wounds or abrasions beneath the plaster. This we believe to represent a real danger, usually but not always indicated by localized pain and general temperature rise. This danger was realized in one of the cases of thigh fracture which the Harvard Unit turned over in plaster to the Pennsylvania Unit, with an unexplained temperature. The cause of this temperature our more acute successors sought, and discovered to be concealed suppuration near the knee. But we were all impressed, I think, with the considerable degree of comfort which these dressings offered. A careless but well-meaning agile auxiliary could jar the bed of these patient poilus and yet be awarded a smile of forgiveness which made no demands upon the heroic spirit.

The Problem of the Cripple. Orthopedic phases of military surgery will continue to demand attention long after all physical

[1] Med. Klinik, April 12, 1915.
[2] Paris Médical, March, 1915.
[3] Bull. de l'Acad. de Méd., March 23, 1915.
[4] Presse Médicale, December 30, 1915.
[5] Paris Médical, November 13, 1915.
[6] Ibid., August 21, 1915.

wounds are healed, and even after the disagreements of the nations which caused these wounds shall have been settled. The burden of the cripple which reconstructive peace as well as destructive war must bear would seem to be a burden which orthopedic surgery should accept and should strive to lighten.

In this short paper we must only mention among these the problems of prostheses. In the spring of 1915 there were 7000 French soldiers who needed artificial arms and legs. The annual French supply was 700. These lantern slides from the book by Spitzy and Hartwich show that among laborers, and even artisans, elaborate and expensive apparatus is often not only unnecessary, but may be even undesirable.

The vocational training of cripples has been largely assumed in times of peace by orthopedic surgeons, and its organization should be their task. It behooves us to anticipate this possible necessity. One of the most imaginative experiments in this direction has been carried out at Chailly, in England, where the returning crippled soldiers are housed in the buildings of a cripple school and taught trades by the crippled children themselves.

We have discussed briefly some of the possibilities for orthopedic service during a war and after a war. I should like to direct your attention for a moment to a preventive phase which I believe to be of real importance.

At the Ambulance, Dr. Smith-Peterson and the reader examined the feet and inspected the shoeing of a hundred soldiers and attempted to discover whether they had suffered from foot discomfort which had interfered with their efficiency. More than half of these men had had bad blisters from ill-fitting and badly balanced shoes. Some of them had suffered from foot strain and weakened arches. A few had actually acquired foot deformities. Their efficiency had been in all cases at least temporarily lessened, and in many cases seriously impaired for a considerable time. In the early days of the war an Englishman stationed at a small hospital in the north of France has told me that when the French troops came streaming by as they were retiring, before the march of the Teutons was checked at the Battle of the Marne, sometimes half a company would be foot-sore and laggards. You may remem-

ber that before the war M. Humbort, the reporter of the Army Committee, proclaimed the artillery were short of ammunition and that the infantry wore boots thirty years old and had not enough of these.

The foot of the average American is no more resistant than that of the Frenchman, and we have yet to undergo the toughening experience of universal military training which they had experienced. By careful examination and muscle-balance tests of recruits and by careful shoeing, we believe serious foot-strain and most foot discomfort can be eliminated. It *should* be so eliminated.

Orthopedic Preparedness. There can be no difference of opinion as to the wisdom of medical preparedness. This should surely concern itself first with the antebellum organization of general base hospitals, the selection of their staffs, and the securing of their equipment. But along with this should go the organization of certain of the specialties for coöperative work. You are all familiar with the incalculable service which the dental profession has rendered, and with the demand for the most skilful and specialized plastic surgery which has been created. We are convinced that orthopedic surgery also has its obligation to meet. It may interest you to know that to this end committees of the American Orthopedic Association and of the Orthopedic Section of the American Medical Association have been appointed and united under one chairman, Dr. Goldthwait, and they are now at work. The available American orthopedic surgeons have been ascertained, their qualifications estimated, possible locations for general orthopedic hospitals are being obtained, and their equipment assured. It is a satisfaction to find the Federal Government eager to coöperate in this preparation.

At the onset of the war many of us were uncertain whether orthopedic surgery had any important service to offer. Those who have had even a little experience during the war have been impressed by the magnitude of this opportunity. Those men who like Colonel Jones are in the thick of it have been sorely pressed by its actual tasks. We appreciate the recognition of this phase of military surgery by the College of Physicians.

THE OPERATIVE RESULTS OF FRACTURES[1]

By FRED. T. MURPHY, M.D.
ST. LOUIS, MO.

It is a real pleasure to come to Philadelphia to talk about the American Ambulance, since without a Philadelphian—Dr. James P. Hutchinson—work at the Ambulance would not have been possible for any of us. Also, work at the Ambulance last year would have been very much less pleasant had we not had Dr. Harte to help us over the rough places. It is with a great deal of trepidation that one comes to Philadelphia to speak on fractures, where the traditions of Agnew and Ashhurst hold us to this subject. Imagine then my consternation to find that, although your Chairman had asked me to take part in a general discussion on the question of fractures, I found that I was expected to read a paper on "The Operative Results of Fractures." So far as the operations go, I think the only reason for my having that special part is perhaps because it was my good fortune to have a series of jaw cases to operate and a very large series of secondary operations following the compound fractures. I think, in a general way, that one might say that extensive operations lead to bad results in these badly comminuted cases, and I shall attempt to show you the reason for this in a series of lantern slides. In the graft cases the jaws do very well. You have an ample blood supply and the question of infection is not so important. In the grafts of the extremities because of old infections the results were relatively bad. In seeing these fracture cases one is impressed

[1] Read January 22, 1917.

with the contributions that have been made in the matter of splints. There is the ambulatory or the transportation splint, and the overhead Balkan type of splint. The comfort with which the patients can be treated with these splints is almost beyond description and they are certainly beyond anything we had conceived of before. The fixation also it seemed to me equals that to be obtained with any other method. In fact, the method is so admirable that Dr. Blake made the remark to me that after treating fractures with these splints he had come to feel that probably never again would he operate for any fracture unless it be some very unusual complicated one with a locking of the fragments. He said that until he took up the question of fractures seriously he had in many instances operated thoughtlessly; but that realizing the possibility of the counter-weights and pulleys he felt that with conservative and continued treatment probably any fracture could be reduced. In expressing an opinion in regard to any part of this surgery it must be remembered that such expression is only an individual opinion. So varied are the conditions under which wounds are seen that no man has been able to analyze and digest the information which might have been received from some other quarter. I preface what I have to say about plasters with that remark because it is so in contrast with the opinion of Dr. Osgood. My feeling about the use of plaster as I saw it used at the Ambulance in Le Panne and Compiègne is that a degree of intelligence is required from the man using the plasters that was beyond that which could be expected from any average hospital staff; and it seemed to us last fall at the Ambulance that we obtained the same comfort with less effort and without the possible disadvantages of the plaster.

The question of irrigation Dr. Lee will take up in detail. There again the individual experience with different types of wounds leads to widely divergent views. One group of men would think after seeing compound fractures managed in one way at a certain base that that specific treatment had a very definite effect. Another group would see exactly the same fractures and yet feel that the treatment was without any very specific effect.

I will show by the slides the manner in which these fractures are repaired and emphasize some of the particular points which I have made. (Exhibition of slides.)

So, the point then in my whole contribution to the evening would be that it is absolutely harmful to interfere in these cases of infected and comminuted fracture except to drain. In talking with a colleague he said, "Yes, but if a spicule of bone were loose and you have your finger in the wound, should you not take it out?" I told him that it would be the greatest temptation in the world to take it out if the finger were in, but that everything, whether loose or falling out, should be packed in and left, and that if left the results would be proportionately good.

PLASTIC OPERATIONS[1]

By RICHARD H. HARTE, M.D.

To try and review the whole question of plastic surgery would be entirely out of the question at the present time. The work as it presented itself in the American Ambulance was particularly interesting from various points of view, especially when we consider the character of the injuries and the results incident to the great loss of substance from which these patients suffered.

It might seem, to the uninitiated, strange why so many head and face injuries occurred in the present war. It must be remembered that the larger portion of the body is protected by the trenches, and only the head is exposed, and consequently is more liable to be injured as a result of shell explosion and bullet wounds from snipers who are constantly on watch for any object which may present itself.

The head wounds as presented at the American Ambulance varied from the ordinary gunshot wound, most of them passing down from the upper part of the face through the mouth and often destroying a large part of the roof of the mouth without (really) leaving any great amount of destructive evidence externally, and again often carrying away or destroying a considerable portion of the inferior maxilla. This explains why we had so many traumatic cleft palates to repair.

Again the great destructive influence we had to contend with was the result of shell wounds and the hand grenades which you can see must necessarily be terribly destructive to the soft parts.

[1] Read January 22, 1917.

Many of the cases which confronted us there were patients who had long since received their wounds, resulting in great loss of substance and an immense amount of cicatricial contraction. In some instances, portions of the face and nose were lost—all of the lower jaw, and in some the tongue and floor of the mouth were entirely exposed and often there was no trace whatever of anything left below the superior maxilla which in itself was frequently much destroyed.

Many times we were at a loss to know really what was the best thing to do under the circumstances. I recall one case as a result of shell wound with loss of mouth, nose and one eye. A previous attempt had been made to work out some problem to make a nose and part of face. A portion of a rib had been removed and engrafted in the tissues of the forehead. After considering carefully this case, my feeling was that any attempt toward making a nose by any of the classic methods would be sure to meet with failure, as there was nothing upon which to graft it except a large amount of cicatricial tissue with low vitality, and any attempt to engraft new material upon this old cicatricial foundation would surely be followed with sloughing. My feeling in this instance after restoring the mouth was that much better cosmetic results could be obtained by using some form of artificial nose attached to a pair of spectacles. With the use of an artificial nose and eye this patient is quite presentable.

The one underlying principle in dealing with any of these cases of loss of substance of the face is an attempt should be made from the very earliest time after the inception of the injury to mold the soft parts as much as possible by the introduction of large retaining sutures or the use of adhesive plasters or bandages. In that way much time can be saved ultimately in trying to correct a great amount of cicatricial contraction which need not have occurred had proper methods been pursued earlier in the care of these cases.

One important fact that should never be lost sight of in dealing with these cases from an operative point of view is not to do too much at one time, as radical operations are liable to be followed

with destructive sloughing. Therefore in my experience and the experience of others much better results can be obtained by a number of repeated less radical operations.

Sometimes the question of procuring flaps for closing in some of the big losses is rather a difficult problem, although I found that frequently by taking flaps well down on the chest and neck they could be swung around, and in one particular case the whole floor of the mouth was restored by taking flaps from part of the neck and chest, and was quite successful. It must be remembered that these cases as groups are all unnourished, as the feeding problem is often the most difficult one and only liquid food can be ingested; often a patient can be fed only through the nares through a tube in which milk and eggs are conveyed into the pharynx, and then to the stomach. A group of these patients in a ward are often particularly trying to our nurses, and often a nurse would have to give up the care of these men at the end of a couple of weeks, as the feeding hour to one not familiar with this work was particularly distressing and repulsive. However, these cases were most generous to each other and assisted in administering the food, one to the other, in a manner which was really quite remarkable.

Many were deprived of the means of comfort from the much-beloved cigarette and the only way they could satisfy their desires was by the introduction of the cigarette into the nostril. I am thankful to say that after our work was completed, the group of these cases we had in the American Ambulance could use and enjoy the cigarette in the normal way and it was more than appreciated.

In referring to operative procedures, I found often a great deal could be done by the use of novocain, even the restoration of a considerable amount of loss of substance of the palate. These patients, as a rule, bore anesthetics rather badly and the administration of anesthesia materially interfered with the field of operation and its use necessarily prolonged operation.

Wounds, from their close proximity to the mouth and nasal passages, were always difficult to keep clean and it was almost

impossible to have a perfectly non-infected wound, although as a rule where the vascularity of the face was not too much impaired by the cicatricial tissues these wounds united very quickly and kindly.

The sutures that we found most useful were sometimes the old hare-lip pin, silk and silkworm gut. For cleft-palate work we found the best results could be obtained with a small needle with a sharp curve. This seemed really to work out very well and often better than many of the more complicated needles which are used for this sort of work. In Paris it was impossible to obtain satisfactory needles and we were forced to depend upon our own ingenuity by making needles in the dental department of the style and character we found most useful. Not infrequently we were compelled to make needles which would suit individual cases according to curve, etc.

The assistance obtained from the dental department under the care of Dr. Hayes and Dr. Davenport was most valuable, and had it not been for their coöperation it would have been impossible to carry out much of the work which we were able to do. The work being done by the dental department in the way of intra-dental splints and obturators is really very remarkable, and assisted enormously in bringing about some of the results which we were able to obtain.

In summing up my experiences in plastic work at the American Ambulance I should say first in importance is the careful molding of the case during the cleansing process after the inception of the injury; careful study of the case in question to learn exactly what was to be done and how best accomplished; to know exactly the condition of the tissues and their vitality; and in attempting to restore the parts to avoid trying to do too much at one time, as these cases, as a rule, do not lend themselves readily to a prolonged operation and the necessary anesthesia; if possible a local anesthetic is desirable.

Of course some cases are emotional and it is rather difficult to manage them under these conditions, but our experience was that after being associated with these patients for a few weeks

they soon came to have implicit confidence and would allow one to do anything suggested and as a rule were ready to coöperate and willing to help out in any way in the after-treatment. Of all the surgical cases I have ever been associated with I never was thrown with a more appreciative and considerate class of men than these poor wounded French soldiers, and I am now in possession of many letters which I have received from time to time from their friends at home thanking me for what I had done to help to restore what would otherwise have been a most distressing condition.

DISCUSSION

Dr. Richard H. Harte: On the program I am down to make some remarks in regard to the plastic work done in the American Ambulance. To be considered in regard to plastic work are (1) the character of the wounds, and (2) the question why there are so many wounds of one character. Consider for a moment the condition in which the majority of the men are: Their feet are six feet under the ground and their heads about six inches below the ground; every head exposed for a moment is liable to receive a wound from the hands of a well-placed sniper. Again, as you know, a large amount of the fighting is being done with hand grenades, with shells thrown from one front to the other bursting in close proximity to the faces of the men in the trench. Consequently, there is a great number of these injuries. Then, again, the position of the man modifies very much the character of his wound. For instance, we were at a loss to understand why certain wounds of the mouth were of such a character. I think, however, we shall understand this if we remember that much of the fighting is done with the man not in the erect position, but bending downward and forward, with his head alongside of the gun as he is ready to shoot. Consequently, many of the bullet wounds were received in the upper part of the skull, passing downward and through the roof of the mouth. This explains why so many cases of traumatic cleft palate are seen in the American Ambulance.

The wounds observed in the American Ambulance were, of course, in largest number those of gunshot injuries, either from rifles with the high-velocity bullet or from the machine-gun and shell wounds. All kinds of injuries to the face were received. Naturally, many of the men with severe injury of the head succumbed and never found their way out

of the trench, being brought out only to be buried. It was a case of the survival of the fittest that found their way to the base hospital of the American Ambulance. In these cases there was always a large amount of laceration of the tissue, dependent, of course, upon the character of the wound. There was also a disposition before these cases were sent to the hospital to leave them, as it were, in the hands of Nature. If the man survived very often his wound was of such a nature that it had cicatrized, contracted, and presented a very difficult problem for the unfortunate person who attempted to restore the man's features.

One very important feature in dealing with all these injuries of the face and soft parts was that of attempting to mold the parts, introduce sutures, apply adhesive plaster, or simply bandage in the effort to prevent gaping of the wound.

I may say that all rules which we had previously followed in plastic surgery seemed here to fail. Many times we scarcely knew what to do, and only after study for a considerable length of time could we come to any definite conclusion upon the best plan of procedure. In many cases there was not only destruction of the soft parts, but injury of the bony parts as well. The hard palate and large portions of the under jaw were often entirely torn away. Again, we would see multiple fractures —three, four and five fragments. It was largely due to the assistance rendered by Drs. Hayes and Davenport in dental work that certain results obtained in plastic surgery were possible. The introduction of the intra-dental splints bridging the gap between the stumps of the maxillæ gave a groundwork for the plastic operation.

The nourishing of these patients formed an important question. The tissues being vascular, there was always a certain amount of hemorrhage, and the patients were often pretty well exsanguinated. One point in plastic surgery which should never be lost sight of is that of what to do and what not to do. This is particularly true in many of the cases seen in the American Ambulance. Flaps may be readily lost by sloughing if we are too radical in our work. Fortunately, we were saved from any bad results from sloughing, although in some of the cases we narrowly escaped. Another point is that there is no use in doing anything with flaps unless they are well nourished. It was curious to note that in many of the flaps taken out and moved around there were large cicatricial bands running across them, cutting off almost entirely the nutrition. In our experience these cases did much better by having these bands dissected away. Those patients in which deglutition was markedly interfered with were the most pitiable, and the ward in which these men were was termed "The Chamber of Horrors." To see these men attempt to take their meals was anything but a pleasant sight. They usually were fed

by a catheter introduced through the nose or mouth and the liquid food allowed to trickle down into the throat. They were very considerate of each other, and often one man would be seen feeding another, by whom he would be fed in return.

I have taken out a few of my photographs which will illustrate what I mean in saying there are certain things to do and certain things not to do in plastic surgery. Often the thing not to do is the most important element.

Dr. R. Tait McKenzie: I have been particularly interested in the discussion upon the orthopedic side because that was an important phase of the treatment of convalescent soldiers under my care during my year's service with the Royal Army Medical Corps in England. In those great camps or depots of about 4000 patients each—and I was medical officer in charge of the one at Heaton Park—we got the ultimate results of the work of the surgeons, and if in peace time the surgeon is apt to try to clear his beds for new cases, that is multipled a hundredfold in war time; and sometimes it seemed to me that the first and only object of the commanding officer of a hospital was to get the beds empty as soon as possible so as to get as many new cases as he could. One part of the orthopedic work not touched upon by Dr. Osgood, but which to me was very interesting and important, is the general treatment of scar tissue. Following most extensive operations and in all cases where there is much tearing there was an enormous amount of scar tissue to deal with which often proved to be a very great problem. Not only were massage, stretching and splints required, but the avoidance of massage was just as important in the early cases to prevent tearing the newly forming bloodvessels and breaking down of the organizing tissue and producing thereby an unduly large cicatrix. As the scar became sound, one began with massage and the use of splints placed so as to exert constant tension on the contracture. Afterward when pain did not persist exercises and manipulations were used to stretch the sound tissue as well as the scar and so to overcome the contracture. This routine treatment obtained excellent results in cases which at first appeard to be very unpromising.

I have been much impressed by the splendid plastic work which is being done in the American Service in France as shown in the slides exhibited by the President. Many of these cases of serious facial deformity in which plastic surgery had done all it can do, are made presentable only by the wearing of an artificial nose, or eye, or sometimes an entire artificial cheek. One case came to us at Heaton Park with the whole of the malar bone gone, the man having been shot as he was sighting his rifle at the loop hole of the trench. The bullet tore away the cheek and

left a deep groove. We sent him up to London where he was fitted with a thin metal mask painted to match his complexion by a soldier sculptor, and he was afterward able to act as chauffeur. These men are naturally very sensitive because of their repulsive appearance. If they can be made presentable a very great service is done for them. It is no wonder that many of them commit suicide from hopelessness over their appearance.

Dr. J. S. Lawrence, Baltimore: I have brought with me slides made from bacterial charts of cases which were in the American Ambulance during September and October of 1916. Several of them are made from patients mentioned by Dr. Lee and show that his statements were quite conservative; for example, I have the chart of the compound fracture of the humerus which he mentioned as having been sterilized in fifteen days. This wound when clean was closed by suture and in fifteen days more the man was discharged with only a simple fracture remaining.

The application of the treatment is perhaps a little more difficult than the reading of it would indicate: (1) The irrigating solution must be accurately titrated so that there may be enough free chlorine and yet not too much. The aim of the amount of chlorine is to inhibit the growth of the bacteria rather than to kill them, for a solution of sufficient strength to kill germs would also be harmful to tissue. (2) The proper sized tube must be used and it must be carefully placed so that every portion of the wound may be irrigated every two hours and also that not too much fluid may be used so as to wet the bed. But most important of all is the bacteriological control, for it is only in this way that the surgeon can know that he is properly treating the wound. The speed with which the count is reduced from infinity to a minimum is most amazing. When the count is as low as one microbe to two oil-immersion fields on an average, it is said to be within the operating limit and when it remains thus for six to eight days the wound is considered bacteriologically clean and ready for closure or any surgical work that may be indicated. Careful study has shown at least 20 per cent. of such wounds to be absolutely sterile. Greatest care must be exercised in dressing these clean wounds when they are within the operating limit, for any slip in technic will reinfect them and thus time will be lost.

Our proportion of good results was very encouraging right from the start although we did not have the same ratio of success as Dr. Carrel, yet we were convinced that our failures were due to our mistakes. In November I visited Dr. Carrel at Compiègne and found him treating the same class of patients as we had; mostly infected wounds of more than a week's standing when they come to the hospital. Our mistakes were most natural. When a wound is infected it is very difficult to bring one's self

afterward to think of it as perfectly sterile, and unconsciously we at times reinfected a clean wound. Then when a wound showed a minimum count there was a great temptation to close it immediately without holding the count thus for the six to eight days because of the fear of reinfection. And in closing wounds there was great danger of attempting to save too much tissue and close under tension.

Of the claims that can be made for the good results of this treatment aside from the shortening of the time of healing must be noted the minimum scar that remains. There are none of those knotty scars which commonly persist after a chronic infection. A number of flesh wounds surprised us by closing spontaneously when the bacteria were removed.

The bacterial count charts are a great assistance to the chief surgeon on his rounds. A glance at the chart tells whether the wound is doing well while it has been demonstrated that a glance at the wound may be misleading. A great amount of pus does not necessarily mean a great number of bacteria nor does the absence of pus indicate the absence of bacteria. We found that some wounds would be stimulated to excessive pus production while the number of bacteria was very small and others that looked very clean were swarming with bacteria.

The Carrel treatment when properly carried out is effective against any type of infection. We treated our cases of B. welchi infection by laying the area of infection wide open and establishing irrigation. The infection quickly yields to the power of the solution. In our experience the streptococcus infection was the most persistent.

At present this method of treating infected wounds has been installed at Johns Hopkins Hospital. As yet the time is too short to report results but we are greatly encouraged by the progress shown by the bacterial charts.

THE DIAGNOSTIC AND PROGNOSTIC SIGNIFICANCE OF SPINAL FLUID FINDINGS[1]

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The hypothesis that paresis, tabes, and, in fact, most of the manifestations on the part of the nervous system originate at the time of the general infection in the first year is tenable for the following reasons:

1. From 25 to 35 per cent. of syphilitic individuals have positive findings in the spinal fluid during the first year of their infection. This number, I believe, is greater than the total number of cases of syphilis of the central nervous system, but it is fair to assume that a certain proportion of infected individuals are spontaneously cured or influenced by the ordinary methods of treatment.

2. Patients with tabes or paresis seen years after their primary infection not infrequently give a history of having had during the first year of the disease, headache, oculomotor paralyses, irregular pupils, defects of hearing, or facial paralysis. These symptoms, which were very vaguely interpreted until systematic examination of the spinal fluid was made, are now known to depend on a syphilitic meningitis due to the invasion of the fluid by the spirochetes. Under the old-fashioned therapy, mercury by mouth or injections combined with iodide of potassium, these lesions often disappeared and the patients were discharged by the physician as cured. Under modern procedures, however, they are considered

[1] Read February 7, 1917.

potential candidates for tabes, paresis, or some other form of cerebrospinal syphilis until a negative blood and fluid have been obtained by persistent treatment.

3. Patients have been observed from the secondary period who at that time showed manifestations on the part of the central nervous system. The symptoms regressed, the patients followed important business careers for years, and the spinal fluid when examined after a latency of ten to fifteen or more years was found to be positive.

4. The persistence of spirochetes at the site of the original lesion in sclerotic changes in the tongue, the cornea in keratitis of congenital syphilis, the viscera, and cardiovascular system has been demonstrated or rendered extremely probable by focal relapses.

The correctness of the foregoing hypothesis can only be definitely proved by a long period of observation and by the serological examination of a large number of patients in all stages of the disease. If it can be demonstrated that a patient who has been free serologically from involvement of the nervous system in the first year or two later on becomes positive, then proof is afforded that the fluid may be involved after the general spirochetemia from somatic foci. We know that abnormalities may be present in the fluid with few clinical signs, or the latter may be so transient that they excite no special attention on the part of the untrained observer. The patient is treated in a perfunctory manner, his headache or oculomotor paralyses disappear, and he is considered cured. He has had no fluid examination and his physician fails to grasp the significance of his symptoms. He may be competent for years to attend to his ordinary business and then develop pains or weakness in his legs or evidence of mental unsoundness, all of which are frequently wrongly interpreted by his adviser. Many such cases have been observed. The patient during the years which have intervened between his primary infection and the appearance of these symptoms has harbored spirochetes in the central nervous system which caused slow

degenerative changes in the posterior columns, multiple foci of meningitis, or meningovasculitis of the brain or cord or perivasculitis of the small vessels in the brain, with the mental deterioration which we call paresis. It is needless to say that combined and transitional types occur which make an ever-varying picture. Until, therefore, accurate proof is afforded that cerebrospinal syphilis may develop from organisms in different parts of the body at varying times after the secondary period the future of the patient is more secure if we assume a primary infection of the fluid in the secondary stage only, and base our treatment and prognosis on the data afforded by this assumption.

The syphilographer should be able to make a neurological examination and interpret the objective signs of neurosyphilis. He should appreciate the value, the absolute necessity of a lumbar puncture where these objective or subjective manifestations are present. He should be prepared to administer to the patient the medication by the proper channels and be equipped with laboratory facilities to observe and control the treatment so directed. It will unfortunately be many years before such radical views are accepted by the profession and syphilographers in sufficient numbers trained to handle the cases which present themselves. In the meantime, paretics and tabetics will fill our asylums and charitable institutions and tax the resources of our communities for their care. Eventually the importance of the problem will be recognized, standardized methods of diagnosis and treatment will be employed and the number of individuals rendered mentally and physically incompetent will be diminished. The importance of the problem and the possibility of prophylaxis offered by an acceptance of the views presented should engage the attention of our health authorities and philanthropists. We have accurate diagnostic methods and specific remedies for syphilis. We can control in a manner our therapeutic procedures. Why should we not attempt to prevent thousands of infected individuals from becoming objects of charity? The tuberculosis problem has occupied the best endeavors of our leading health author-

ities; hundreds of hospitals are devoted to its care. Little can be accomplished except from the general stand-point of hygiene. Syphilis is a problem of equal or greater importance. It affects innocent women and children. It is acquired in accidental ways. It causes race deterioration, shortens life, produces incurable imbeciles and helpless cripples. Our public-spirited citizens look on it as a stigma and disgrace and a well-deserved punishment for the guilty individual. A campaign of education is needed for the non-medical public and well-directed efforts for its treatment and eradication. If we accept the hypothesis as a working one we are compelled by the logic of the situation to puncture all our early cases of syphilis before a final pronouncement as to cure. If the fluid is normal after one or two years of treatment, with the other requirements fulfilled, we may safely promise the patient immunity as to cerebrospinal syphilis, with the possible exception of gummata and the vascular type of the disease which may involve the brain vessels as a part of à general arteriosclerosis. An exploratory operation in obscure abdominal conditions is daily performed, but many physicians oppose lumbar puncture because of theoretical dangers under the mistaken impression that their diagnostic powers are sufficient to cope with the various types of cerebrospinal disease. The information afforded by examination of the spinal fluid is of vastly more importance for the future welfare of patients than abdominal exploration, and much simpler.

During the past four or five years, in connection with the clinical work, we have conducted a laboratory which has enabled us to carefully correlate the clinical and serological findings based on a large number of cases of tabes, paresis, and other types of cerebrospinal syphilis from private, clinic, and hospital practice. In addition about 150 cases of secondary syphilis have been punctured, from which findings it has been possible to deduce certain lessons and to substantiate the clinical observation that the involvement of the cerebrospinal axis takes place during the early period of the disease. For convenience we may tabulate cases of cerebrospinal syphilis in the following groups:

1. Typical tabes.
2. Abortive or rudimentary tabes.
3. Taboparesis.
4. True paresis.
5. Optic atrophy.
    (*a*) With tabes.
    (*b*) With paresis.
    (*c*) Existing by itself.
6. Epilepsy.
7. Other cases of cerebrospinal syphilis including:
    (*a*) Meningo-endarteritis.
    (*b*) Gummata.
    (*c*) Arteriosclerosis or endarteritis.
    (*d*) Neuroses and psychoses.

From the investigations systematically carried out on the spinal fluid, certain reactions are looked upon as presaging severe intractable forms of the infection. A strongly positive Wassermann reaction in the high dilutions, *i. e.*, 0.4 c.c., 0.2. c.c., or less of fluid, with a paretic curve, indicates in the vast majority of cases a paresis or a potential paresis. We have been able to predict the development of dementia paralytica before any gross manifestation appeared. The symptomatology of this disease as given in text-books refers to the stage of degeneration with its stigmata of speech and hand-writing defects, expansive ideas, or marked depression. Years before this terminal stage changes are present about the small vessels throughout the brain, which cause the pleocytosis, the globulin excess, and the positive Wassermann. Intraspinal and intravenous medication delay the degenerative changes, but a cure with our present therapeutic methods is seldom or never attained. To cure paresis the diagnosis must be made in its incipiency, and this can only be done by spinal-fluid examination in the first year of the infection. Even in this early stage a cure is only theoretically possible, but offers more hope than when we await the clinical signs of the disease. The following cases illustrate not only the difficulties to be overcome from a serological stand-point, but typical paretic findings in the first year:

Woman, aged thirty-three years, admitted to the City Hospital September 15, 1915, with a secondary eruption and mucous patches. She had suffered with headaches for two months; the left pupil was larger than the right, both sluggish to light; deep reflexes hyperactive and unequal. Her fluid examined February 11, 1916, showed: cells 34, globulin ++, Wassermann ++++ to 0.2, and a paretic curve. In April she had five epileptiform convulsions.

Man, aged twenty-seven years. Initial lesion of finger in January, 1916, followed by maculopapular rash. In July he complained of severe headaches and vague somatic pains. In October, after 15 salvarsan and 30 mercurial injections, he was seized with severe occipital pain, marked vertigo, and unsteadiness in gait. His pupils were unequal; reflexes exaggerated. Lumbar puncture showed: cells 52, globulin ++++, Wassermann ++++ to 0.1; paretic curve.

The following case observed from the early secondary period illustrates the neurasthenic vorstadium of general paralysis and emphasizes the necessity of routine lumbar puncture:

Dentist, aged thirty-six years. Infection of the finger in February, 1913, followed by a maculopapular syphilide. Treatment was begun with the onset of secondary symptoms, and consisted of two courses of salvarsan of 6 injections each and 46 injections of mercury salicylate, gr. iss to gr. iij each. His Wassermann reaction failing to remain negative a further course of 25 injections of gray oil, followed by several months of mixed treatment, was given. During this time the patient was very apprehensive and nervous, which nervousness he attributed to inability to obtain a permanently negative reaction. He passed from observation for over a year, when he again presented himself in May, 1916, his Wassermann was three plus, and it was found that the left pupil was slightly larger than the right; both reacting well to light and accommodation. All the reflexes were hyperactive, the left more so than the right. A lumbar puncture showed: cells 172, globulin +++, Wassermann ++++ to 0.2, and with the Lange a paretic curve. Under intraspinal therapy his cells have

been reduced to 10, his globulin ++, his Wassermann ++++ to 0.6; paretic curve still present. The case is interesting in that objective manifestations were so slight, and subjectively the only symptom elicited was nervousness.

The statement made by many neurologists that early treatment has little or no effect in preventing nervous-system involvement contains a partial truth, for in certain cases early syphilis of the nervous system is not influenced by the ordinary channels but only after the more direct method by intraspinal medication.

In tabes a positive pleocytosis, globulin increase, a positive Wassermann in low dilutions, and a luetic curve offer a favorable prognosis as to amelioration or cure. A high cell count in tabes means an active meningitis, and may be present late or early in the affection. The symptoms which accompany these fluid findings depend on the location of the process in the lower or higher segments of the cord. Such cases are amenable to treatment, and we can confidently promise an arrest of the condition. The gastric crises, pains, and bladder weakness entirely disappear and the ataxic gait undergoes extraordinary improvement. In those cases in which the active inflammatory process has been replaced by sclerosis the prognosis is determined by the negative findings.

In radiculitis where the roots of the posterior nerves are involved the lesion consists of an arachnoiditis with moderate serological findings, the Wassermann being positive only with larger amounts of fluid, 1 to 1.5 c.c., or even negative with 2 c.c. The symptoms are those of pain, sensory disturbances, Argyll-Robertson pupils, and sometimes gastric crises. Unless the pathological change extends to the posterior columns the reflexes are preserved. These cases respond favorably to treatment.

Lumbar puncture is of special value in abortive or rudimentary tabes, with pupillary phenomena as the only conspicuous evidence of a pathological process. These cases may or may not have a positive Wassermann in the blood, and the fluid findings are either negative or show only a slight increase in cells, with a trace of globulin. We may assume that they were originally a high tabes in which the process has undergone spontaneous cure.

The examination of the fluid has practical value not only from the stand-point of prognosis but of differential diagnosis. Not a small number of individuals with a syphilitic history show pupillary changes. In the absence of abnormalities in the fluid the later development of the tabetic or paretic syndrome is not likely. The value of the examination is especially of moment in chronic alcoholics, because the psychical changes as well as the somatic may simulate those of the tabetic or paretic. Furthermore, these cases are frequently complicated by a history of a former syphilis. Several chronic alcoholics have come within my experience who presented unequal, fixed and irregular pupils with changes in the reflexes in whom syphilitic disease of the central nervous system could only be excluded after lumbar puncture. In one case the patient had had syphilis twenty-five years previously, his pupils were irregular and fixed to light, his knee-jerks were absent and he suffered from lancinating pains in the lower extremities. He was very irritable, suffered from loss of memory and other signs of mental deterioration. His fluid was absolutely negative. This patient had been markedly alcoholic for over thirty years. In another case, a woman, aged thirty-nine, who for a number of years had been addicted to the use of alcohol there was no history of syphilis and her blood was negative. Her left pupil was larger than the right, both were sluggish to light, her knee-jerks were hyperactive, she had suffered from occipital headaches for three months and was very worried and anxious. Her spinal fluid was negative throughout.

There is also a relation between arteriosclerosis and cerebral endarteritis and the pupillary condition. Unequal, fixed, or sluggish pupils being found in patients with a previous syphilis whose only positive finding in the fluid is an excess of globulin.

A patient, aged forty-nine years, giving a history of syphilis thirty years ago, came with the complaint of a nervous break-down three weeks before, with hysterical attacks, and severe shooting pains in his legs. Examination showed lingual hemiatrophy of two years' duration, unequal, irregular, and fixed pupils, and hyperactive reflexes; his Wassermann was negative and continued

so after a provocative injection of salvarsan. His fluid revealed only an abnormal amount of globulin. He was examined thirteen years ago by Dr. Leszynsky, who reports the findings today are the same as at that time with the exception of the atrophy of the tongue.

Attention has been called to the titration of the fluid in the diagnosis of tabes, taboparesis, or paresis. If it is positive, with the original amount of 0.2 c.c. or less, then we have presumptive evidence of taboparesis or paresis. Since, however, certain cases of progressive tabes and cerebrospinal lues also give a reaction in these high dilutions, we have a more valuable corroborative or differential agent in the colloidal gold solution. In tabes complicated by paresis the diagnosis can be made long before the development of the mental syndrome from the serological findings. The fluid Wassermann remains positive for years in spite of treatment, and the Lange test shows complete decolorization in the paretic zone. A number of these patients observed for years have developed typical paresis while others are under treatment and clinically show no mental deterioration. The prognostic import of the colloidal gold test and persistent positive Wassermann is illustrated in the case of the patient whose family I warned two years ago of the danger of the development of paresis. In the past six months he has developed expansive ideas, and has involved his family in serious financial complications.

In rabbit syphilis eye involvement is interpreted by Nichols and Reasoner as indicative of nervous syphilis, being the equivalent of an intensive invasion which in man is expressed by some form of cerebrospinal lues. In human syphilis, however, such changes as keratitis, retinitis, and choroiditis, with few exceptions, have been accompanied by a negative cerebrospinal fluid, and objective findings referable to central nervous disease have not been elicited. It is possible that in ocular syphilis the lesion is such a localized one that the Wassermann-producing bodies are not in sufficient number to give a reaction in the spinal fluid, at least with our available methods. Although the blood in these cases may be four plus, there is no evidence that the complement-

binding powers pass into the fluid unless there is simultaneous involvement of the meninges or nerve tissue.

Every case of secondary syphilis, as a matter of routine, should have an ophthalmoscopic examination from time to time. Marked evidence of pathological changes may be present with slight subjective symptoms or impairment of vision, and the condition may be completely overlooked unless one is on the alert for the possibilities in these cases. Only recently a patient came to my attention who six to eight months after his primary lesion had complained of blurring of the right eye for which he went to one of the out-patient departments, where he was given glasses to remedy the condition. He was under antiluetic treatment at the time and the condition gradually subsided. Now, two years after his infection, and after 16 injections of salvarsan and 70 of mercury, he again has blurring and severe shooting pains in his head and right eye. Ophthalmoscopically an optic neuritis is demonstrable. Serologically he has cells 210, globulin ++++, and Wassermann ++++ to 0.1 with a luetic curve.

In eye syphilis positive clinical manifestations are frequently present with a negative blood, as in a man who developed in his early secondary period, one month after treatment with four full doses of salvarsan, a perivasculitis. Under mercury the eye lesions regressed, and with its discontinuance a relapse from a new focus took place, which again improved under further therapy. Three months after the cessation of all treatment his Wassermann was four plus.

From Uhthoff's statistics on optic-nerve disease in 100 cases of cerebrospinal syphilis controlled by autopsy, 50 per cent. showed some involvement. Papillitis was noted 14 times, optic neuritis 12, simple optic atrophy 14, disturbances of vision without demonstrable changes in the fundi 7 times, and lesions without complaint on the part of the patient 3 times. He estimated that 8 per cent. of general paralytics suffered from optic atrophy and 2 per cent. from optic neuritis, while 10 to 15 per cent. of tabetics show an optic atrophy.

The optic nerve may be primarily or secondarily involved,

much more often the latter. In the former the nerve substance itself, without compromising the meningeal covering, is attacked by gummata or endarteritis of the Huebner type; while in the latter there is an extension meningitis. In the former the fluid is usually negative while in the latter it is positive. During the era before our systematic laboratory examination in these cases an isolated optic atrophy was diagnosed as latent tabes, and Nonne still regards such cases as tabetic in view of the fact that cases of tabes may begin as an optic atrophy and persist as the only symptom for years, as many as twenty. The laboratory findings, it seems to me, give a better indication of the nature of the process, especially in the early cases, and supply more definite data upon which to base a diagnosis and prognosis. Cases of optic atrophy might therefore be classified in three groups.

Group 1. Including those cases in which no other physical abnormalities are present and the fluid findings are negative or practically so.

Group 2. Cases which clinically give a history of lancinating pains and have sluggish or absent reflexes; in other words, more or less advanced tabes with a positive lymphocytosis, positive globulin, positive Wassermann, and a luetic curve. The blood may or may not be positive.

Group 3. Cases which on physical examination give the findings of tabes or paresis with or without mental phenomena. These cases differ from group 2 in that the Wassermann is resistant to treatment and a paretic curve is present.

Epilepsy is met with in syphilis as a symptomatic form due to meningitis, meningo-encephalitis, or gummatous infiltration or attacks which are indistinguishable from the idiopathic type. In two cases of acquired syphilis, with attacks of genuine epilepsy, in both of which the blood was four plus, the fluid findings were negative. Epilepsy is said to occur in 5 to 7 per cent. of congenitally syphilitic children. In a child, aged seven years, with a status epilepticus, no abnormalities were present in the fluid although the blood was positive. Epileptiform seizures are a frequent concomitant of paresis and often the initial clinical

symptom of the disease. In these cases the fluid is invariably positive.

A congenitally syphilitic child punctured recently, owing to unusual features, warrants the recital of a few details. She is now four and a half years old and was born nearly five years after the marriage of her parents, both of whom were ignorant of their infection. The child was healthy until three months old, when she had lesions about her mouth, which were diagnosed as luetic, her blood was four plus, and the Wassermann made on the mother and father at that time gave a similar result. The child was treated with pills, developed normally, talked and walked at thirteen months, was unusually sturdy looking, and when fifteen months old had an attack of hemiplegia. She was unconscious three or four days. Her antiluetic treatment by mouth was continued until April of last year, when she began having attacks of petit mal, nine to twelve daily. Under intravenous treatment of salvarsan these were reduced to five a day. She was punctured the latter part of November, 1916, and it was found that she had 26 cells, globulin ++, Wassermann ++++ to 0.2, and a paretic curve. Since the puncture she has not had a single attack of petit mal, her nystagmus has cleared up, she walks better, and is again beginning to talk. The mother, the father and baby brother, aged two and one-half years, all have a four plus Wassermann reaction in the blood as well as positive findings in the spinal fluid, consisting of a moderate lymphocytosis, globulin, positive Wassermann and a luetic curve. Petit mal is sometimes encountered as the result of reparative processes in syphilitic cerebral disease. In a woman suffering from syphilitic meningitis with severe headaches the fluid and blood became negative under continued treatment. Her headaches have ceased, she has regained her weight and former energy, but is having two or three attacks of petit mal daily.

In meningo-endarteritis the reaction of the blood is positive in 70 to 80 per cent. of cases, and the spinal fluid is usually positive, the findings depending upon the intensity of the meningitis. In pure endarteritis we have found only a positive phase I (globulin)

in the fluid with sometimes a normal and sometimes a luetic curve with the gold sol. We have made no punctures in cases of simple cerebral gummata. The brain apparently is not a predilection site for solitary gumma. According to autopsy findings, quoted by Dr. Larkin, gummata of the viscera are twenty times more frequent than those of the brain.

Conclusions. Tabes, paresis, and certain types of cerebrospinal syphilis originate in fluid infection in the secondary stage. Our hope in preventing degenerative changes with permanent mental or physical disability lies in the systematic examination of the spinal fluid before the patient is discharged as cured. The fluid may contain spirochetes, with few or no symptoms, until an acute condition is precipitated, such as aphasia or localized paralyses.

We may summarize the prognostic significance of spinal fluid findings somewhat as follows: A complete arrest of the pathological changes may be anticipated in early syphilis by intensive treatment. This applies to the presence of a paretic curve with the other phases positive. In tabes with a pleocytosis, a positive Wassermann in the low dilutions, and luetic curve the prognosis is favorable as to arrest of the meningitis and prevention of the extension of the degeneration. We have a number of cases with persistent negative findings and absence of symptoms.

In cerebrospinal syphilis response to treatment is usually prompt and the results permanent in the absence of secondary areas of softening, as hemorrhage following endarteritis.

OBSERVATIONS ON TYPES OF RESPONSE IN TREATMENT OF SYPHILIS OF THE CENTRAL NERVOUS SYSTEM[1]

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In a short discussion of treatment of syphilis of the central nervous system it is practically impossible to consider all phases of the subject. With the recent simultaneous development of new methods of diagnosis and new forms of treatment, our knowledge of the results of therapy must necessarily rest upon an experimental basis. The object of this communication is, therefore, to present detailed observations in the treatment of various forms of the disease and to point out certain conclusions from these observations.

It is well established that the central nervous system is involved in all stages of the disease. While it is thought by many syphilographers that the future course of the disease is largely determined by the invasion of the nervous tissues in the early secondary period, still the various clinical pictures depend upon numerous factors, such as time since infection, amount of treatment, tissues involved, and certain unknown influences in resistance and immunity at present but little understood. In the days when nosology dominated the study of the disease, various types, such as syphilis and parasyphilis, were described. This classification

[1] Read February 7, 1917.

was useful, and even today, when combined with the more modern methods of laboratory examination, is not without value in prognosis and to a certain extent as a guide in treatment.

For convenience in classifying, the various types may be grouped under three main headings:

1. *Vascular.* The essential lesion is an endarteritis, and the nervous lesion is due to disturbed circulation.

2. *Exudative.* The most marked lesion is cellular thickening of the supporting membranes or perivascular spaces, with gumma formation and subsequent mechanical injury to cortex, tracts, and intradural portions of nerves.

3. *Parenchymatous.* The striking picture is tract or cortical degeneration, but in which the essential lesion is probably a chronic meningitis and perivasculitis. At least this appears to be true of the various tabetic manifestations. In paresis a true inflammation of the cortex seems to exist. This peculiarity in the paretic process probably explains the intractability of this condition to treatment.

The pessimism of many of the older neurologists in regard to permanent cure of central nervous syphilis probably arose because of their failure to take into consideration all of these factors; indeed, many of the differences have been only recently appreciated. On the other hand, the statement that all forms of central nervous syphilis respond equally well to intensive general medication must be the result of insufficient observation of a sufficiently wide variety of cases. By the presentation of the details of the treatment of a number of patients, I hope to prove that treatment must be individualized, and that the response in the cerebrospinal fluid is one of the most important guides to both the kind, and sufficiency of treatment.

The order in which the records are presented is determined to a certain extent by the stage of the disease. This order, however, is modified by various factors, such as clinical forms and peculiarities in laboratory findings.

GROUP I. *Early Meningitis.*

TABLE 1

W. E., male, aged twenty-five years.

October 18, 1911. Primary.

November 15. Severe headache; hyperesthesia of scalp.

November 28. Salvarsan, amount unknown.

December 26. Deafness in right ear; headache.

January 22, 1912. Salvarsan, amount unknown.

April 11. Admitted. Headache and nervousness; physical examination negative, except exaggerated reflexes and hyperemia optic disks.

Date.	Blood.	Cerebrospinal fluid.			Treatment.	
	Wassermann reaction.	Cells.	Noguchi globulin.	Wassermann reaction.	Salvarsan.	Mercury.
1912						
April 16	++	190	±	0.8 c.c. ++++		
May 6–May 20	..	..	..	....	3 x 0.3 gm.	
22	++++	23	±	1.0 c.c. ++++		
29–June 11	..	..	..	....	3 x 0.3 gm.	
une 19–June 27	..	..	..	....	2 x 0.6 gm. neo.	
July 2	++	7	–	1.0 c.c. –		
11	..	..	..	....	0.6 gm. neo.	4 inj. Hg. sal.
Sept. 6	++++	4	–	1.0 c.c. –		
9–Sept. 23	..	..	..	....	5 x 0.9 gm. neo.	25 rubs.
Nov. 22	++	0	–	1.0 c.c. –		
25–Jan. 1	..	..	..	....	6 x 0.9 gm. neo.	3 inj. cal.
1913						
April 8	++++	5	–	1.0 c.c. –		
1–May 27	..	..	..	....	8 x 0.5 gm.	2 inj. Hg. sal.
Sept. 30	+	1	–	1.0 c.c. –		
Oct. 1–Feb. 16	..	..	..	....	12 x 0.5 gm.	4 inj. Hg. sal.
1914						
Feb. 16	–					
April 27	–	1	–	1.0 c.c. –	0.5 gm.	
1915						
Feb. 3	–	6	–	2.0 c.c. –		
15	–	..	..	....	0.4 gm.	
16	–					
19	+					
25	+					
Mar. 1–May 15	..	..	..	....	....	30 rubs.
May 15	–					
1917						
Jan. 15	–	6	–	2.0 c.c. – Gold curve: 1111100000		

CASE I (W. E.) is an illustration of severe involvement of the meninges in a very early stage. With the appearance of headaches, even before the cutaneous manifestations, and deafness two months after the appearance of the chancre, we are justified in assuming that the eighth nerve was implicated in a basal meningitis. The results of single early injections of salvarsan are well demonstrated, for although the symptoms were temporarily relieved, the essential process was not eliminated, as

shown by the first lumbar puncture. The ease with which the abnormal elements in the fluid may be eliminated by systematic treatment is well shown, for following eight intravenous injections of salvarsan in three months' time the fluid became practically normal. There was a simultaneous disappearance of symptoms. A year and a half of continuous intensive treatment was required, however, before the serum Wassermann reaction remained negative.

The manner in which this patient responded to treatment is fairly typical of that usually seen in early meningitis. Six out of a group of 8 such cases have shown a similar response to persistent intensive general therapy. Several of them likewise showed a tendency for the symptoms to recur when early treatment was applied in a desultory manner.

Case II (C. W.) is an example of a true neurorelapse. The patient did not have any symptoms of central nervous origin until an interval had elapsed after the first course of salvarsan. Then a clinical picture appeared which pointed to severe and extensive involvement of the basal meninges. The general nervous symptoms were as severe as often seen in the second stage of tuberculous meningitis, and the cerebrospinal fluid showed a pleocytosis more intense than is often present in this disease.

The clinical improvement and diminution in abnormal elements in the cerebrospinal fluid promptly followed the administration of repeated injections of 0.2 gm. of salvarsan. The diminution in pleocytosis was slower than in Case I. Twice, March 8, and October 26, 1912, there was an increase in the cell count while the patient was receiving intramuscular injections of mercury. This fact is of especial interest in connection with the occurrence of his first attack during intensive mercurial treatment. Only by persistent application of salvarsan over a period of three years with occasional short courses of mercury, could the spinal fluid be brought to a permanent normal condition. The persistence of a normal cerebrospinal fluid and of a negative serum Wassermann reaction during two years without treatment, and the negative results of provocative treatment seem to indicate that the disease is completely eradicated. This case illustrates how important

the repeated examinations of the cerebrospinal fluid may be, for the recurring pleocytosis under mercury served as an indicator of the necessity for salvarsan. The superiority of salvarsan over

Table 2

C. W., male, aged thirty-four years.
May 2, 1911. Primary.
May 27. Secondaries.
June 9 to 24. 1.5 gm. salvarsan.
July to August. 6 inunctions and 12 injections of Hg.
August 19. Stiffness of neck; headache; dizziness.
August 23. Deafness; facial paralysis.
Sept. 23. Admitted; headache; dizziness; mental dulness; exaggerated reflexes; deafness; facial paralysis.

Date.	Blood. Wassermann reaction.	Cerebrospinal fluid.			Treatment.	
		Cells.	Noguchi globulin.	Wassermann reaction.	Salvarsan.	Mercury.
1911						
Sept. 23	++++	1094	++	0.2 c.c. ++++		
27–Oct. 12	..	..	..	....	3 x 0.2 gm.	
Oct. 16	++++	118	+	0.2 c.c. −		
19–Nov. 29	..	..	..	....	7 x 0.2 gm.	
Dec. 5	+++	60	+	1.0 c.c. ++		
7–Dec. 14	++	..	..	....	2 x 0.2 gm.	
1912						
Jan. 8–Jan. 15	..	..	..	....	....	2 inj. Hg. sal.
21	−	9				
21–Mar. 4	..	..	..	....	....	6 inj. Hg. sal.
Mar. 8	+	46	+	1.0 c.c. +		
12–April 16	..	..	..	....	6 x 0.3 gm.	
April 18	−	11	±	1.0 c.c. −		
May 7–May 28	..	..	..	....	3 x 0.3 gm.	
31	−	8	−	1.0 c.c. −		
July 16–Oct. 7	..	..	..	....	....	6 inj. Hg. sal.
Oct. 19	+	..	..	....	0.9 gm. neo.	
26	++++	22	−	1.0 c.c. −		
26–Dec. 14	..	..	..	....	7 x 0.9 gm. neo.	
1913						
Jan. 13–Mar. 25	..	..	..	....	....	7 inj. cal.
April 12	+	6	+	1.0 c.c. −		
Mar. 29–April 19	..	..	..	....	3 x 0.9 gm. neo.	
April 26–June 21	..	..	..	....	6 x 0.5 gm.	
June 19–Aug. 18	..	..	..	....	....	6 inj. Hg. sal.
Aug. 30	−	3	±	1.0 c.c. −		
Sept. 13–Feb. 21	..	..	..	....	16 x 0.5 gm.	
1914						
Feb. 21	−	6	±	1.0 c.c. −		
April 25–Sept. 7	−	..	..	....	9 x 0.5 gm.	
1915						
Jan. 21	−					
June 12	−	..	−	2.0 c.c. −		
1916						
July 3	−	7	−	2.0 c.c. −	Gold curve: 0000000000	
Oct. 23	−	..	..	....	0.3 gm. sal. provocative.	
25	−					
28	−					
30	−					
Nov. 2	−					
7	−					

mercury is also elicited. This is doubtless the type of case which terminated fatally from meningitis in the presalvarsan era.

Table 3

W. R., male, aged thirty-four years.

Date.	Blood. Wassermann reaction.		Treatment.		
			Salvarsan.	Hg. sal., intramuscular.	$HgCl_2$. pills p. o.
1912					
Jan. 29	..	Primary lesion			
Mar. 29	..	Rash; adenopathy; mucous patches			
30 to June 25	..	..	3 inj.; total, 1.65 gm.	13 inj.; total, 1.0 gm.	2.5 gm.
July 29	−				
Sept. 19	++				
Oct. 5 to 1913	..	..	7 inj.; total, 4.2 gm.	18 inj.; total, 3.3 gm.	9.4 gm.
Mar. 29					
May 21	−				
July 16	+++				
23	+++±				
28 to Sept. 20	−	..	..	6 inj.; total, 0.8 gm.	2.6 gm.
20 to Nov. 28	..	..	7 inj.; total, 4.0 gm.	8 inj.; total, 1.3 gm.	2.4 gm.
28 to 1914	..	..	4 inj.; total, 2.4 gm.	10 inj.; total, 2.0 gm.	2.6 gm.
Feb. 25					
25 to May 18	..	..	3 inj.; total, 1.7 gm.	8 inj.; total, 1.6 gm.	3.3 gm.
July 7	−				
Aug. 10	++++				
12 to Oct. 6	..	..	..	..	2.6 gm.

Date.	Blood. Wassermann reaction.	Cerebrospinal fluid.				Treatment.		
		Cells.	Glob.	Wassermann reaction.	Gold.	Salvarsan, intrav.	Serum, int. sp.	$HgCl_2$, pills.
1914								
Oct. 9	..	65	+	0.4 c.c. ++++	..			
24	..	..	..	..	..	0.6 gm.	20 c.c. 40%	
Nov. 6	..	..	..	..	..	0.6 gm.	30 c.c. 45%	
Dec. 4	..	30	++	0.8 c.c. ++++	..	0.6 gm.	52 c.c. 50%	
1915								
Jan. 8	..	..	..	..	....	0.6 gm.	..	
29	..	..	+	1.0 c.c. ++++	..	0.6 gm.	32 c.c. 40%	14.6 gm.; KI, 133 gm.
Mar. 26	..	..	....	..	..	0.5 gm.	..	
May 1								
June 4	..	20	..	0.8 c.c. ++++	..	0.6 gm.	40 c.c. 50%	
July 9	..	..	..	..	..	0.5 gm.	40 c.c. 50%	
30	..	..	..	..	..	0.6 gm.	40 c.c. 50%	
Aug. 13	..	5	±	1.0 c.c. −	..	0.6 gm.	40 c.c. 50%	
Oct. 1	..	..	±	2.0 c.c. ++++	..	0.5 gm.	40 c.c. 50%	
29	..	..	−	2.0 c.c. ++++	..	0.6 gm.	36 c.c. 50%	
Nov. 19	..	..	..	..	..	0.45 gm.	40 c.c. 50%	
Dec. 18	..	3	+	1.5 c.c. ++++	..	0.35 gm.	36 c.c. 50%	5.6 gm.
1916					00000			
Jan. 28	..	..	−	2.0 c.c. −	00000	0.4 gm.	40 c.c. 50%	
Feb. 5		..						
Mar. 17	..	..	−	2.0 c.c. −	..	0.4 gm.	30 c.c. 40%	
May 20	−	3	−	2.0 c.c. −	00000 00000			
Aug. 1	−	5	−	2.0 c.c. −				
Nov. 26	−	2	−	2.0 c.c. −	00000 00000			

Case III (W. R.[1]) is an example of how apparently a lesion of the central nervous system may be a focus from which the serum Wassermann reaction may repeatedly relapse. Three times during a period of two and one-half years the reaction reappeared in the serum when treatment was discontinued. The patient was able to take mercury in large quantities, and each subsequent course of treatment was more intensive than the last. The only symptoms or signs of central nervous system involvement were very active reflexes. Still in October, 1914, a lumbar puncture revealed the presence of an active meningitis. The form of treatment was then changed to less intense general therapy with the addition of intraspinal injections of the patient's own serum obtained after intravenous salvarsan injections. Under this new mode of treatment, there was steady improvement in the condition of the cerebrospinal fluid until it became entirely normal. Two more combined treatments were given after which all drugs were discontinued. Contrary to the experience in the first two years the blood Wassermann reaction has not relapsed and, moreover, the fluid has remained normal.

This case seems to prove that in certain patients even in the secondary period intensive general treatment may not be sufficient to control an infection in the cerebrospinal axis, and that intraspinal therapy in addition may be necessary.

These 3 cases illustrate the variations in response in the secondary period. The first was easily influenced by salvarsan intravenously, and there was no tendency to a relapse when treatment was discontinued. The second was more resistent and relapsed when mercury was substituted for salvarsan. In the third the most intensive general application of salvarsan, mercury, and iodides, was not sufficient to eliminate the meningeal lesion. Only after intraspinal injection of serum was the active syphilitic lesion eliminated.

In all the patients the only clinical residuum of their nervous lesion is the persistence of very active deep reflexes. It is conceivable that as a result of the former inflammatory process

[1] The patient was under the care of Dr. A. R. Stevens who kindly furnished the notes.

there may be a certain amount of scarring which has affected the upper motor neuron.

GROUP II. *Later Forms of Central Nervous Syphilis of the Exudative Type.*

TABLE 4

M. P., male, aged twenty-six years. Syphilitic meningitis; retrobulbar neuritis and atrophy.

January 5, 1909. Chancre; spirochete+.

January 5 to March. Arsacetin, 30 injections hypodermically.

March, 1909, to March, 1910. Hg. intramusc., 100 inj.

March to July. Pills, 100.

July, 1910, to July, 1911. Pills and KI.

July, 1911. Salvarsan intramuscularly; suppuration.

January, 1912. Salvarsan intramuscularly.

July, 1912. Sodium cacodylate 18 injections; fulness in head; flashes of light; pain in legs.

October 20, 1912. Admitted. Retrobulbar neuritis and atrophy; narrowing of visual fields.

Date.	Blood.	Cerebrospinal fluid.			Treatment.		
	Wassermann reaction.	Cells.	Glob.	Wassermann reaction.	Salvarsan, gms.	Hg.	
1912							
Oct. 25	−	40	+	1.0 c.c. −			
27 to	..	..	..	..	..	Hg. sal., 14 inj.; total, 0.8 gm.; KI, 4 gm. a day	
1913							
Jan. 23							
23	−	59	±	0.6 c.c. ++++	..	..	Visual fields normal.
28	−	..	..	..	Neo., 0.6		
Feb. 4	±	..	..	..	" 0.9		
11	±	..	..	..	" 0.9		
15	++++	..	..	..	" 0.9		
22	++++	..	..	..	" 0.9		
Mar. 1	++++	..	..	..	" 0.9		
8	++	..	..	..	" 0.9		
15	+++	..	..	..	" 0.9		
22	..	..	..	..	Sal., 0.5		
April 4 to	..	..	..	..	..	Hg. sal., 0.5 gm. total.	
June 16							
21	+++	4	−	1.0 c.c. −	..	..	Fundi and visual fields normal.
28	..	..	..	..	Sal., 3 x 0.4 gm.		
July 12	++						
Sept. 18	..	7	−	2.0 c.c. −	Sal., 0.5 gm.		
1914							
Jan. 6 to	..	..	..	..	..	Hg. sal.; total. 0.5 gm. hyp.	
Feb. 9							
23	+	..	..	..	5 x 0.5 gm.		
May 25	−						
1915							
June 21	−	1	+	2.0 c.c. −	..	..	Fundi normal color; arteries narrow; fields normal.

Case IV (M. P.) is an example of a patient in whom the first nervous symptoms appeared nearly four years after infection. For the first two years he was under the care of Professor Milian, of Paris. During this time he received fairly intensive antisyphilitic treatment. During the eighteen months before admission to the Rockefeller Hospital his treatment was more desultory in character. When first seen he had evidently a fairly active meningitis and retrobulbar neuritis with much narrowing of the visual fields. Because of his previous intensive arsenic treatment, it was felt that the effect of mercury and iodides should be tested before resorting again to an arsenical. For this reason the patient received mercury and iodides for three months with marked improvement in the condition of the visual fields, but, at the same time, the cerebrospinal fluid showed no tendency to become normal. Following a course of full doses of neosalvarsan, and a short course of mercury intramuscularly, the cerebrospinal fluid became normal, the visual fields remained normal, and the fundi showed no abnormality except slight narrowing of the arteries. The provoking of a strong Wassermann reaction from a negative phase during the course of neosalvarsan is noteworthy. Because of the persistence of the Wassermann reaction in the blood serum, treatment was continued for another ten months. The patient then disappeared from observation, but upon his return a year later it was found that his general condition was normal and that the only abnormality in the cerebrospinal fluid was a slight increase in globulin. This persistence of excess globulin has been seen in many cases in whom all other pathological elements of the cerebrospinal fluid were entirely lacking. This case is an illustration of the fact that it is safe to use large and repeated doses of salvarsan in patients with marked involvement of the optic nerve, and also that the exudative type frequently responds to persistent general medication.

Case V (D. Y.) is an example of the marked exudative type of lesion occurring many years after infection. It is probable from the history of the case that the patient contracted a marital infection at least twenty years ago. Except for headaches she

had never suffered symptoms referable to disease of the central nervous system until two months before admission. At the time of the first examination, both the clinical findings and the cerebrospinal fluid gave evidence of a marked increase in intracranial pressure. In this type of case we feel that it is wise to introduce treatment with mercury and large doses of iodides before resorting to salvarsan, in order to eliminate the possibility of a Herxheimer reaction. In one month's time there was a

Table 5

D. Y., female, aged fifty-one years. Syphilis of cerebral meninges; infection (?).

October 10, 1915. Headache; weakness of left leg and left face; thickness of speech; improved; for past two weeks progressive stupor; headaches; weakness.

November 30, 1915. Admitted. Disorientation; rigid neck; double-choked disk; exaggerated reflexes; incontinence of urine; fever.

Date.	Blood. Wassermann reaction.	Cerebrospinal fluid.				Treatment.		
		Cells.	Glob.	Wassermann reaction.	Gold.	Sal., gms.	Hg. gms.	KI, gms.
1915								
Dec. 2	++++	161	++	0.6 c.c. ++++				
4–17	..	..	..	..	..	..	11 rubs	
17	++++	..	..	..	..	0.25	..	229
17–28	..	..	..	..	..	0.3	3 rubs	
30 to	++++	50	+	2.0 c.c. ++++	..	..	..	103
Jan. 8	..	..	..	..	..	0.3		
15				Discharged much improved.				
Feb. to	..	..	..	..	..	..	Rubs, 14 per mo.	"Some."
June							for 4 mos.	
to	..	..	..	..	..	..	No treatment	
Dec. 17			R	eadmitted. Anemia.		Gastric ulcer.		
19	++++	4	±	2.0 c.c.	11221 00000			

remarkable improvement in the clinical signs, a diminution in the choking of the disks, and a very gratifying improvement in the condition of the cerebrospinal fluid. After six weeks of treatment the patient insisted upon going home and continued treatment there for four months. Treatment was then stopped and after two or three months, there were symptoms pointing to the presence of a gastric ulcer. She was readmitted in December, 1916, with headaches, severe anemia, vomiting, and hematemesis. It was thought that this might be due to a gastric crisis, but further

investigation confirmed the diagnosis of gastric ulcer, and on Lenhartz' diet, and after two transfusions, the headaches disappeared and the patient's condition was much improved. At the time of her second admission, the cerebrospinal fluid was normal except for a slight globulin excess and a very weak luetic type of gold curve.

The case is a striking example of satisfactory improvement in the cerebrospinal fluid and clinical symptoms which was effected largely by the use of mercury and iodides.

Table 6

I. C., female, aged thirty years. Cerebral syphilis for three months; infection (eleven years?).

October, 1916. Convulsions; unconsciousness followed by strabismus and diplopia.

December 26, 1916. Admitted. Unequal pupils; ptosis of right lid; strabismus; right choked disk; left optic neuritis; left facial paralysis.

Date.	Blood. Wassermann reaction.	Cerebrospinal fluid.				Treatment.			
		Cells.	Glob.	Wassermann reaction.	Gold.	Intrav. salvar.	Intrasp. serum.	Hg., gms.	KI, gms.
1916									
Dec. 28	+++	10	++	1 c.c. ++++	55555	..	..	$HgCl_2$,	
to					42100			5 x 0.012	
Jan. 8	..	..	..	..	..	..	..	4 rubs	56
11	+++	..	..	..	..	0.1 gm.	..	..	158
18	++++	2	+	2 c.c. +	..	0.1 gm.	..	..	
25	++++	4	+	2 c.c. −	11232	0.25 gm.	15 c.c.	..	
					11000	..	100%		

Case VI (I. C). While the exact time of infection cannot be determined in this case, it was probably about eleven years before admission. The case was interesting because of the uncertainty in diagnosis. With an initial symptom of convulsions and unconsciousness, the diagnosis of paresis was highly suggestive. The physical examination, however, revealed a condition which was more easily explained by a diffuse basilar process involving both optic nerves, the oculomotor nerves on both sides and the left facial nerve. The low cell count was unusual with extensive meningitis. The gold curve, however, was of a typical paretic type. As with the former patient, treatment was instituted by

means of mercury and iodides. Because of salivation after a short course of mercury small doses of salvarsan were given. After three weeks of treatment there was a marked improvement in the cerebrospinal fluid and after four weeks the cell count was normal, the globulin less and the Wassermann reaction negative. However, because of the initial gold curve of the paretic type, it was felt that the most intensive treatment should be instituted at once, hence intraspinal injections of serum were given. The treatment was followed by a disappearance of the strabismus, marked improvement in the ophthalmoscopic picture, and general clinical betterment. Both the clinical improvement and the tendency of the cerebrospinal fluid to become normal, have been comparable in rate to that usually seen in exudative syphilis. In fact, had it not been for the paretic gold curve we would not have hesitated to make a diagnosis of basilar meningitis. The rapid reversal of the gold curve toward the luetic type, moreover, confirms this diagnosis.

These 3 cases illustrate how well patients suffering from central nervous syphilis of the exudative type respond to general treatment. This response is manifest not only by clinical improvement, but by a rapid disappearance of the abnormal elements in the cerebrospinal fluid. Whether a paretic type of gold curve, as seen in Case VI, will alter the prognosis, is a question for the future to decide.

Group III. *Tabetic Type.*

In tabes dorsalis, new problems confront us. It is probable from the history of many of these patients that even before the appearance of clinical symptoms, an inflammatory condition of the meninges has existed for years. It is only after a sufficient number of tracts or nerves have become involved to call forth symptoms that the patient's attention is directed toward the true nature of his disease. Certain cases seem to be spontaneously arrested and occasionally the cerebrospinal fluid is practically normal. In such patients there is often no further advance in clinical signs or symptoms. On the other hand, in the majority of patients, the condition of the cerebrospinal fluid points to an

active inflammation, and the disease is progressive in nature. Because the active part of the disease manifests itself mostly in the cord and surrounding meninges, this condition is most favorable to local therapy applied by means of lumbar puncture. However, every patient does not require intraspinal therapy; many of them respond satisfactorily to general treatment.

TABLE 7

J. F., male, aged sixty-four years. Tabes dorsalis (ten years?); syphilis?

Date.	Blood. Wassermann reaction.	Cerebrospinal fluid.			Treatment. Salvarsan intravenously.
		Cells.	Globulin.	Wassermann reaction.	
1914					
Oct. 28	++++	23	+	0.4 c.c. ++++	
31	..	..	..	..	0.3 gm.
Nov. 12	++++	..	..	..	0.35 gm.
28	++++	..	..	..	0.5 gm.
Dec. 12	++	..	..	..	0.4 gm.
29	..	..	..	..	0.4 gm.
1915					
Feb. 4	..	..	..	..	0.5 gm.
Mar. 20	++++	6	±	1.0 c.c. −	0.3 gm.
April 16	+++	..	..	..	0.3 gm.
June 20	++++	..	..	..	0.3 gm.
Oct. 26	+++	..	..	..	0.3 gm.
Nov. 23	++++	..	..	..	0.3 gm.
1916					
May 17	..	4	−	2.0 c.c. −	0.3 gm.
June 7	++	..	..	..	0.3 gm.
30	±	..	..	..	0.3 gm.
July 21	..	..	..	..	0.3 gm.
1917					
Jan. 19	+	..	..	..	0.3 gm.
Feb. 16	+	20	±	2.0 c.c. +++	1112100000 gold.

CASE VII (J. F.) is an example of this response. He had suffered from "rheumatic pains" in the legs for over ten years, and was known to have had sluggishly reacting pupils, and diminished knee-jerks in 1904. In 1912 he obtained considerable relief following a course of mercury injections. For four months he has had vertigo, weakness, and numbness in the left arm and both feet. On examination he showed Argyll-Robertson pupils, slight deafness in left ear, a band of hypo-esthesia and hypo-algesia about the chest; deep pain sensation lost in tendo Achillis and in right testicle; slight ataxia in legs; slight Romberg; triceps, patellar and Achilles reflexes absent. The cerebrospinal fluid indicated an active meningitis. He was easily poisoned by salvarsan in large

doses or when too frequently repeated, nevertheless, moderate treatment soon brought the cerebrospinal fluid to normal. Because of the patient's sensitiveness to salvarsan, subsequent injections have been given at longer intervals. There has been no tendency for the cerebrospinal fluid to become abnormal even though treatment was stopped for intervals of six months. He has shown no advance in symptoms, and has been able to resume his work which previous to treatment he could attend to only occasionally.

While in some cases general treatment alone may be sufficient to completely arrest the progress of the disease both from the clinical and laboratory point of view, in other cases some additional form of therapy seems to be required.

Table 8

G. M., male, aged thirty-five years. Tabes dorsalis; duration (?); tabetic arthropathy for two months; syphilis for eleven years.

Date.	Blood. Wassermann reaction.	Cerebrospinal fluid.				Treatment.		
		Cells.	Glob.	Wassermann reaction.	Gold.	Salvarsan, intrav.	KI.	Hg.
1915								
Mar.	++++	23	−	0.6 c.c. ++++	..	Neo., 4 inj.	KI	
April to 1916	++++	..	..	..	..	..	"	Hg. sal., 2 gm.; 30 hypo.
Mar. 0	..	..	..	..	..	..	"	
4	0	4	+	0.6 c.c. ++++	..			
18	0	..	..	..	..	0.35 gm.		
31	+	..	..	..	..	0.3		
April 17	+	..	..	..	..	0.4		
May 8	0	..	..	..	..	0.4		
23	++	..	..	..	..	0.4		
June 6	..	..	..	..	..	0.25		
20	++	7	+	1.0 c.c. ++++	..	0.3		
July 12	0	..	..	..	..	0.3		
26	0	..	..	..	..	0.3		
Aug. 8	0	..	..	..	..	0.3		
24	+	..	..	..	..	0.33		
Sept. 9	++	..	..	..	..	0.3		
23	++	..	..	..	..	0.2		
Oct. 7	++	..	..	..	..	0.4		
Nov. 4	++	..	..	..	..	0.25		
18	..	..	..	..	..	0.3		
Dec. 2	+	29	±	0.6 c.c. ++++	11122 10000			

Case VIII (G. M.) is an example of this. Patient's symptoms of tabes began in 1914 at which time he received salicylate of mercury and neosalvarsan. Upon admission to the Presbyterian

Hospital Dispensary in 1915 he showed signs of an early tabes. Under mercury intramuscularly and iodides there was evidently no advance in the symptoms until suddenly in the early part of 1916, when a Charcot's knee-joint appeared. Upon admission to the hospital he showed incomplete Argyll-Robertson pupils, hypotonia of the knees and hips, effusion into the right knee-joint, hypo-esthesia in both legs, pain conduction delayed in the legs, deep pain sensation much diminished in the right tendo Achillis, but present in the left. Sense of position lost in the ankles and toes. Some incoördination in legs; deep reflexes present in arms and legs. His cerebrospinal fluid contained only four cells per cm., but the Wassermann reaction was as intense as one year previously. After nine months' treatment with salvarsan the Wassermann reaction is present in the same strength, and there is an increase of pleocytosis. There has been no advance in symptoms, and as a brace has been applied to the leg, the arthropathy is no more marked. It is evident, however, that the active inflammatory condition is not subsiding.

It was because of a similar lack in response to general therapy that we[1] originally sought some additional form of treatment. As it had previously been shown that the serum of salvarsan-treated patients had some general therapeutic effect, it was decided to determine whether intraspinal injections of this serum would be beneficial in a condition like tabes dorsalis. In order to submit this theory to the severest test the patient was first treated only intraspinally.

Case IX (C. H. L.) is an example of the effects which may be secured from the intraspinal injection of serum alone. The patient's syphilitic infection occurred thirty years previously. He had had symptoms of tabes, such as lightning pains and numbness in the legs for the past ten years, and for six months previous to treatment had vomited daily. On physical examination he showed evidences of a fairly advanced tabes with marked superficial and deep sensory disturbances, Argyll-Robertson pupils,

[1] Swift, Homer F., and Ellis, A. W. M.: Jour. Am. Med. Assn., 1911, lvii, 2051; Arch. Int. Med., 1913, xii, 331.

diminished hearing and absence of knee-jerks, one ankle-jerk and much diminished tendon reflexes in arms. The treatment caused a steady diminution in all the abnormal elements in the cerebrospinal fluid. When the fluid was almost normal, five intravenous injections of salvarsan were given and then treatment was discontinued. He returned to his work and for three years the cerebrospinal fluid has remained normal. Because of similar results in several tabetics, we felt that beneficial effects were to be expected from intraspinal injections of autosalvarsanized serum.

TABLE 9

C. H. L., aged fifty years. Tabes dorsalis for ten years; syphilis for thirty years.

Date.	Blood. Wassermann reaction.	Cerebrospinal fluid.			Treatment.	
		Cells per cm.	Noguchi globulin.	Wassermann reaction.	Intravenous.	Intraspinal. Other patients' serum.
1911						
Oct. 25	−	42	+++	0.2 c.c. ++++		
30	..	41	++	0.2 c.c. ++++	..	25 c.c. of 40%
Nov. 6	..	40	++	0.2 c.c. ++++	..	20 c.c. of 40%
18	..	50	++	0.4 c.c. ++++	..	22 c.c. of 40%
Dec. 3	−	18	++	0.4 c.c. ++++	..	26 c.c. of 50%
12	..	17	++	0.2 c.c. ++++	..	30 c.c. of 50%
28	..	15	++	0.8 c.c. ++++	..	25 c.c. of 40%
1912						
Jan. 6	..	15	++	0.2 c.c. ++++	..	25 c.c. of 40%
12	..	10	++	0.4 c.c. ++++	..	30 c.c. of 50%
23	..	14	++	1.0 c.c. ±	..	26 c.c. of 50%
31	..	16	+	1.0 c.c. +	..	30 c.c. of 50%
Feb. 7	..	17	+	1.0 c.c. ++	..	30 c.c. of 50%
Mar. 4	−	15	+	1.0 c.c. ++		
April 10	..	10	±	1.0 c.c. +		
16 to	−	..	..	..	Sal., 5 x 0.3 gm.	
May 14	−					
14	..	9	+	1.0 c.c. +		
Sept. 24	−	8	±	1.0 c.c. −		
1913						
Mar. 28	−	5	−	1.0 c.c. −		
June 21	..	2	−	1.0 c.c. −		
1914						
July 19	−	3	−	2.0 c.c. −		
1915						
July 3	−	3	±	2.0 c.c. −		

The question naturally arose as to whether intraspinal injections of normal serum might not have a similar effect. This was tested in several patients in some of whom it was found that the abnormal elements in the cerebrospinal fluid would disappear under intraspinal injections of normal serum alone. It then

remained to be determined whether salvarsanized serum was more potent than normal serum. The results of such an investigation are shown in:

TABLE 10

J. H. M., aged forty-four years. Tabes dorsalis for two and a half years; syphilis for fourteen years.

Date.	Blood Wassermann reaction	Cerebrospinal fluid.			Treatment.	
		Cells per cm.	Noguchi globulin	Wassermann reaction.	Intravenous.	Intraspinal.
1914						
Jan. 27	++++	100	+	0.2 c.c. ++++		
Feb. 2	++++	69	+	0.4 c.c. ++++	..	30 c.c. of 50% normal serum.
16	+++	20	±	0.6 c.c. ++++	..	30 c.c. of 50% " "
Mar. 2	++++	25	+	0.4 c.c. ++++	..	30 c.c. of 50% " "
16	++++	14	+	0.4 c.c. ++++	..	30 c.c. of 50% " "
30	++++	25	+	0.4 c.c. ++++	..	30 c.c. of 50% " "
April 13	++++	23	±	0.6 c.c. ++++	..	30 c.c. of 50% " "
29	..	22	+	0.4 c.c. ++++	..	30 c.c. of 50% " "
May 29	+++	43	+	0.4 c.c. ++++	..	30 c.c. of 50% sal. serum.
June 1	+++	18	+	0.6 c.c. ++++	..	30 c.c. of 50% " "
22	+++	10	+	0.8 c.c. ++++	..	30 c.c. of 50% " "
July 6	+++	10	+	0.6 c.c. ++++	..	40 c.c. of 50% " "
20	+++	8	+	0.8 c.c. ++++	..	38 c.c. of 50% " "
Aug. 3	+++	14	+	2.0 c.c. ++++	..	40 c.c. of 50% " "
24	+++	20	+	1.0 c.c. ++++	..	40 c.c. of 50% " "
Sept. 7	+++	10	+	0.8 c.c. ++++	..	40 c.c. of 50% " "
Oct. 12	+++	3	+	0.8 c.c. ++++	Sal., 0.5 gm.	40 c.c. of 50% own serum.
26	++++	10	+	1.0 c.c. ++++	" 0.5 gm.	40 c.c. of 50% " "
Nov. 9	++++	5	±	1.0 c.c. ++++	" 0.5 gm.	40 c.c. of 50% " "
Dec. 7	++	5	+	1.0 c.c. ++++	" 0.5 gm.	40 c.c. of 50% " "
21	++++	4	−	1.0 c.c. ++++	" 0.5 gm.	40 c.c. of 50% " "
1915						
Jan. 4	++++	3	+	0.8 c.c. ++++	" 0.5 gm.	40 c.c. of 50% " "
18	++++	3	±	0.8 c.c. ++++	" 0.5 gm.	40 c.c. of 50% " "
Feb. 1	++++	3	±	1.0 c.c. ++++	" 0.5 gm.	40 c.c. of 50% " "
15	++++	4	−	1.0 c.c. ++++	" 0.5 gm.	40 c.c. of 50% " "
Mar. 1	++	3	+	0.8 c.c. ++++	" 0.5 gm.	40 c.c. of 50% " "
April 26	++++	12	+	0.6 c.c. ++++	" 0.5 gm.	40 c.c. of 50% " "
May 10	++++	1	± ?	0.4 c.c. ++++	" 0.5 gm.	40 c.c. of 50% " "
24	+	2	+	0.8 c.c. ++++	" 0.5 gm.	40 c.c. of 50% " "
June 21	++	3	±	2.0 c.c. +	" 0.5 gm.	40 c.c. of 50% " "
July 7	..	4	+	2.0 c.c. −		

CASE X (J. H. M.). This patient had chancroid fourteen years before admission. No secondaries. Two and one-half years ago, numbness in fingers and toes, Argyll-Robertson pupils, absence of knee-jerks. During two previous years patient had received two courses of mercury injections and much potassium iodide, as well as three injections of salvarsan intravenously. On admission he had Argyll-Robertson pupils, diminished hearing, slight patchy hyperalgesia, slightly ataxic gait, definite Romberg, sluggish deep reflexes in arms, and absence of deep reflexes in legs. After seven intraspinal injections, of 50 per cent. normal serum,

the cell count dropped to between 20 and 25, the number of cells remaining practically the same during the latter half of this course of treatment. The globulin remained the same, the Wassermann reaction was only slightly weaker. After eight injections of salvarsanized serum obtained from other patients, the cells dropped to about 10 per cm. Here the drop occurred shortly after the institution of salvarsanized serum injections; the globulin remained the same, but the Wassermann reaction decreased to half its original strength. The institution of combined intravenous injections of salvarsan, and intraspinal injections of patient's own serum, caused a further drop of cells to normal, and weakening of the globulin and the Wassermann reaction. It required, however, fourteen injections of each before the reaction in the spinal fluid became negative. The increase in the pleocytosis and Wassermann reaction while the treatment was discontinued between March 1 and April 14, 1915, is noteworthy. The renewal of treatment, however, led to rapid diminution in the strength of the Wassermann reaction in the fluid as well as in the blood serum. The result in this case seemed to indicate that salvarsanized serum is more potent than normal serum, and that the combined intravenous and intraspinal treatments are more active than either form alone.

After it was established that intraspinal injections alone were of benefit, it was desirable to determine whether the combined form of treatment was more effectual than the intravenous alone. In Case XI this fact seems to be established.

Case XI (C. L. V.) was admitted January 10, 1911, with a history of a genital ulcer sixteen years previously. For past six years increasing lightning pains in legs; in the past two years loss of sense of position in feet and legs and increasing ataxia; nine months ago developed a Charcot hip. On admission patient had incomplete Argyll-Robertson pupils, very ataxic gait, hypotonia of hips and marked hypo-esthesia over lower chest and upper abdomen, entire loss of sense of position in lower extremities, deep reflexes present in arms, absent in legs. At the time of admission he was so weak and ataxic that he required two canes as well as the assistance of

some other person in order to walk. Even though under the influence of mercury, he showed 125 cells and a heavy globulin in the spinal fluid. After the first three injections of salvarsan there was distinct subjective improvement and a gain in weight; the pleocytosis, however, was more marked than in the beginning, the globulin less. Mixed treatment by mouth reduced the number

TABLE 11[1]

C. L. V., aged thirty-five years. Tabes dorsalis for six years; syphilis for sixteen years.

Date.	Blood.	Cerebrospinal fluid.			Treatment.	
	Wassermann reaction.	Cells per cm.	Noguchi globulin.	Wassermann reaction.	Intravenous.	Intraspinal. serum.
1910						
Nov. 10 to 1911	++++	..	..	..	16 inj. of $HgCl_2$ intramuscularly.	
Jan. 10	++					
16	+	125	++	0.2 c.c. −	Sal., 0.2 gm.	
25	++	..	..	..	" 0.3 gm.	
Feb. 8	++	..	..	..	" 0.36 gm.	
13	..	150	±	0.2 c.c. −		
15 to Aug. 20	+	..	..	..	Mixed treatment by mouth.	
21	+	63	+	0.2 c.c. ± ?		
26 to Sept. 22	..	..	..	..	Sal., 5 x 0.2 gm.	
22	±					
Nov. 24	..	26	±	0.2 c.c. −		
Dec. 1	..	..	..	..	" 0.2 gm.	
11	±	50	+	1.0 c.c. +	" 0.2 gm.	18 c.c. of 50%
18	±	20	+	..	" 0.2 gm.	30 c.c. of 50%
1912						
Jan. 5	−	12	±	1.0 c.c. +++	" 0.3 gm.	30 c.c. of 40%
12	−	4	−	1.0 c.c. +	" 0.3 gm.	30 c.c. of 50%
15	−	..	..	..	" 0.2 gm.	
20	..	5	..	1.0 c.c. ± ?		
July 9	−	2	−	1.0 c.c. −		
Sept. 10	−	1	−	1.0 c.c. −		
May 15	−	3	−	1.0 c.c. −		
1914						
Feb. 2	−	Not counted	±	2.0 c.c. −		
Aug. 1	−	3	−	2.0 c.c. −		
1915						
June 24	−	1	−	1.0 c.c. −[2]		

of cells, and further salvarsan treatment caused the cells to drop to 26. Unfortunately, during the first eight months of observation only the smaller quantities of cerebrospinal fluid were used for the Wassermann reaction, hence the cell count and globulin

[1] In this and subsequent cases the intraspinal treatments consisted of injections of the patients' own serum obtained in one-half to one hour, after intravenous injections of salvarsan.

[2] Not tested with 2 c.c.

are the best criteria for judgment of the effects of treatment at this time. After the course of salvarsan was discontinued six weeks the number of cells had risen to 50. The addition of intraspinal to intravenous treatment caused a rapid approximation to normal in the cerebrospinal fluid. At this time the patient also stated that subjectively his improvement had been more marked than at any previous time. For three and one-half years without treatment the cerebrospinal fluid remained normal and there was no advance in the patient's tabetic symptoms.

The importance of treating a patient with tabes until the cerebrospinal fluid becomes normal and remains so is well illustrated in:

Case XII (O. F.). Ten years before admission he had an indurated genital ulcer but no secondaries. At this time mercury pills were administered for three months. Four years ago he was injured in a football game; six months later lightning pains in legs appeared and have continued. Pains in chest for one year. Two years ago band-like sensation below knee. Difficulty in walking for three years. Has instructed himself in Fränkel movements with considerable improvement in walking. On admission pupils showed only slight reaction to light; there was marked ataxic gait, marked Romberg, loss of sense of position in lower extremities, prolonged pain sensation below knees, hypoesthesia over trunk below the second intercostal space, superficial and deep reflexes all absent. When first seen this patient presented the signs of an extensive degeneration of the cord. During the first six months, he received repeated small intravenous injections of salvarsan with some clinical improvement, but only slight alteration in the cerebrospinal fluid. This consisted in somewhat decreased pleocytosis and decreased globulin, the Wassermann reaction remaining about the same strength. During 1912 he would report only occasionally for treatment and discontinued it altogether in the last three months of that year. At the end of this period he suffered a clinical relapse consisting of partial deafness, diplopia, and marked increase in pain. The cerebrospinal fluid showed an increased pleocytosis and increased strength

of the Wassermann reaction. From this time on he faithfully continued treatment, which consisted of combined intravenous

Table 12

O. F., aged thirty-two years. Tabes dorsalis for three and a half years; syphilis for ten years; improvement, relapse, improvement.

Date.	Blood. Wassermann reaction	Cerebrospinal fluid.				Treatment.	
		Cells per cm.	Nog. glob.	Wassermann reaction.		Intravenous.	Intraspinal serum.
				Liver antigen.	Cholesterin heart antigen.		
1911							
April 4	++++	27	++	0.2 c.c. −	..	Salvarsan	
May 18	++	..	..	..	..	5 x 0.2 gm.	
19	..	39	++	0.2 c.c. ++			
Oct. 13	++	..	..	..	..	Sal., 0.2 gm.	
20	+	9	+	0.2 c.c. +	..	" 0.2 gm.	17 c.c. of 40%
27	..	..	..	..	..	" 4x0.2 gm.	
to Nov. 17							
20	..	10	+				
1912							
April 9	−	14	±	0.4 c.c. ++++	..	" 0.3 gm.	30 c.c. of 40%
15	..	..	..	..	..	" 0.3 gm.	
23	+	3	+	0.4 c.c. ++++	..	" 0.3 gm.	30 c.c. of 40%
30	+	..	..	..	..	" 0.3 gm.	
May 7	+	6	+	0.4 c.c. ++++	..	" 0.3 gm.	30 c.c. of 40%
Sept. 23	+	19	+	0.6 c.c. ++++	..	Neo., 0.9 gm.	
Oct. 8	+	..	..	..	..	" 0.9 gm.	
1913	Chol. heart anti.						
Jan. 31	+++	70	+	0.4 c.c. ++++	0.2 c.c. ++++	" 0.75 gm.	
Feb. 7	+++	57	±	0.4 c.c. ++++	0.4 c.c. ++++	" 0.9 gm.	30 c.c. of 40%
14	+++	28	±	0.6 c.c. ++++	0.4 c.c. ++++	" 0.9 gm.	30 c.c. of 40%
28	++++	17	±	0.6 c.c. ++++	0.4 c.c. ++++	" 0.9 gm.	30 c.c. of 40%
Mar. 14	++	14	−	0.4 c.c. ++++	0.4 c.c. ++++	" 0.75 gm.	30 c.c. of 40%
27	++++	7	+	1.0 c.c. ++++	0.6 c.c. ++++	" 0.75 gm.	30 c.c. of 40%
April 9	+++	7	+	1.0 c.c. +	0.6 c.c. ++++	" 0.9 gm.	30 c.c. of 40%
June 3	++++	5	±	1.0 c.c. ++	0.8 c.c. ++++	Sal., 0.5 gm.	30 c.c. of 40%
12	++++	..	..	..	..	Neo., 0.9 gm.	
17	++++	2	−	1.0 c.c. ±	1.0 c.c. ++++	Sal., 0.5 gm.	30 c.c. of 40%
July 2	..	4	−	..	..	" 0.5 gm.	30 c.c. of 40%
15	+++	2	−	..	0.8 c.c. ++++	" 0.5 gm.	30 c.c. of 40%
29	+++	1	−	..	1.0 c.c. ++	" 0.5 gm.	30 c.c. of 40%
Aug. 12	+	3	−	..	0.8 c.c. +++	" 0.5 gm.	30 c.c. of 40%
Sept. 9	+±	..	..	..	..	" 0.5 gm.	
23	−−	2	±	1.0 c.c. −	1.0 c.c. ++++	" 0.5 gm.	30 c.c. of 50%
Oct. 7	−−	3	−	2.0 c.c. ±	2.0 c.c. ++++	Neo., 0.75 gm.	30 c.c. of 50%
21	±±	..	..	..	..	" 0.75 gm.	
Nov. 17	..	..	..	..	..	Sal., 0.5 gm.	
Dec. 1	++++	..	..	..	..	" 0.5 gm.	
22	++++	..	..	..	..	" 0.6 gm.	
1914							
Jan. 19	..	3	−	2.0 c.c. −	2.0 c.c. ++		
27	++						
Mar. 16	++	..	..	..	..	" 0.5 gm.	
30	+++	..	..	..	..	" 0.5 gm.	
April 13	−	..	..	..	..	" 0.5 gm.	
30	±?	..	..	..	..	" 0.5 gm.	
May 28	−	..	..	..	..	" 0.5 gm.	
June 12	−	3	−	..	2.0 c.c. −		
1915							
Feb. 27	−	4	−	..	2.0 c.c. −		

and intraspinal injections given in courses of six to eight treatments followed by free intervals of four to six weeks. Although the improvement in the condition of the cerebrospinal fluid was slow under this treatment, it was continuous and after a year the only abnormality was a weak Wassermann reaction in 2 c.c. quantities. Because of persisting positive reaction in the blood, another course of salvarsan was given intravenously. The behavior of the Wassermann reaction in the blood serum was of interest.

During the first year of the disease the reaction decreased steadily. However, it was only tested with a liver antigen. With cholesterinized antigen a strongly positive reaction continued until September, 1913. Upon the resumption of salvarsan treatment in November of this year, the reaction became strong again, after a month without treatment it was weaker, but again showed a strong provocative phase after which it became completely negative and remained so. When the patient was first seen, although the clinical findings indicated a very advanced tabes, the cerebrospinal fluid findings indicated an active meningitis, Under prolonged and intermittent treatment, the laboratory evidence of active disease disappeared and there was no advance in the tabetic process except possibly the development of complete Argyll-Robertson pupils. The clinical relapse in January, 1913, with a simultaneous increase in pleocytosis and in the Wassermann reaction is worthy of special notice and shows the importance of treating this patient until the cerebrospinal fluid became normal. The addition of the intraspinal to the intravenous treatment seems to have been especially advantageous. The fact that at the end of treatment all laboratory findings were negative and have not recurred indicates a cure.

While the discontinuing of treatment may at times be followed by an increase in the abnormal elements in the cerebrospinal fluid, the contrary is not infrequently seen. This leads us to speak of the importance of giving treatment in courses with periods of rest and of determining what has occurred during these free intervals.

Case XIII (F. H. H.) illustrates this point. Twelve years before admission he had a chancre followed by a rash. He took KI and pills for two and one-half years and inunctions for two months, then four injections of mercury yearly for six years. Four years ago began to tire easily and had dull pains shooting up and down the spine. Six months later he developed weakness in legs and difficulty in walking. He then received thirty-seven injections of mercury with relief from pain. Two years ago had

Table 13

F. H. H., aged thirty-nine years. Tabes dorsalis for four years (?); syphilis for twelve years.

Date.	Blood. Wassermann reaction.	Cerebrospinal fluid.			Treatment.	
		Cells per cm.	Noguchi globulin.	Wassermann reaction.	Intravenous.	Intraspinal. serum.
1913						
Mar. 18	±	24	±	0.2 c.c. ++++		
20	+	42	±	0.2 c.c. ++++	Sal., 0.4 gm.	30 c.c. of 40%
April 17	++	9	±	0.4 c.c. ++++	" 0.5 gm.	30 c.c. of 40%
May 13	+	2	±	0.4 c.c. ++++	" 0.5 gm.	30 c.c. of 40%
June 3	+	..	±	0.4 c.c. ++++	" 0.5 gm.	30 c.c. of 40%
19	+	5	+	0.4 c.c. ++++	" 0.5 gm.	30 c.c. of 40%
July 7	±	2	+	0.4 c.c. ++++	" 0.5 gm.	30 c.c. of 40%
Sept. 19	−	2	−	0.6 c.c. ++++	" 0.5 gm.	30 c.c. of 40%
Oct. 10	−	3	±	0.6 c.c. ++++	" 0.5 gm.	30 c.c. of 50%
24	−	2	±	0.4 c.c. ++++	" 0.5 gm.	30 c.c. of 50%
Nov. 21	−	2	± ?	0.8 c.c. ++++	" 0.5 gm.	30 c.c. of 50%
Dec. 12	−	2	..	0.6 c.c. ++++	" 0.5 gm.	30 c.c. of 50%
1914						
Jan. 16	−	1	−	0.6 c.c. ++++	" 0.4 gm.	
Feb. 6	−	1	−	0.6 c.c. ++++	" 0.5 gm.	30 c.c. of 50%
27	−	2	±	0.4 c.c. ++	" 0.5 gm.	30 c.c. of 50%
April 3	..	1	..	..	" 0.5 gm.	40 c.c. of 50%
May 4	−	1	±	2.0 c.c. ++++	" 0.5 gm.	40 c.c. of 50%
June 5	−	1	..	1.0 c.c. ++++	..	40 c.c. of 50%
July 10	−	4	+	2.0 c.c. ++++	" 0.5 gm.	40 c.c. of 50%
24	−	0	−	2.0 c.c. ++++	" 0.5 gm.	40 c.c. of 50%
Aug. 7	−	1	± ?	2.0 c.c. ++++	" 0.5 gm.	40 c.c. of 50%
Sept. 4	−	2	−	2.0 c.c. ++++	" 0.5 gm.	40 c.c. of 50%
1915						
June 17	−	2	−	2.0 c.c. −		

slight numbness in arms and legs. In January, 1911, two injections of salvarsan; July, 1912, lumbar puncture—66 cells, globulin increased, Wassermann reaction strongly positive, amount not given. September 16 to October 7, 1912, neosalvarsan. Inunctions of mercury for the past month. Condition on admission: Irregular pupils, reaction slowly to light; sensation normal; absence of tendo Achillis and patellar reflexes; no mental disturbance. Because of the markedly abnormal condition of the

cerebrospinal fluid, even though the patient was under the influence of fairly active treatment, it was considered advisable to give combined intraspinal and intravenous injections immediately. There was a prompt diminution in pleocytosis and a steady weakening of the Wassermann reaction. When treatment was intermitted in July, 1913, the fluid continued to show improvement. Slight increase in the intensity of the Wassermann reaction occurred when the treatment was resumed. Treatment was again intermitted in February, 1914, the Wassermann reaction became much weaker and remained of practically the same strength under irregular treatment until September. Treatment was then stopped and a year later the cerebrospinal fluid was normal. There has been no advance in the clinical symptoms. As the patient lives in a distant city, we have been unable to examine the fluid lately.

GROUP IV. *Paralytic Dementia.*

When compared with the rate of diminution of the abnormal elements in the spinal fluid and the arrest of clinical symptoms and signs in tabes, the treatment of paresis has been a distinct disappointment. When compared with the results of our therapeutic efforts in the presalvarsan era, however, treatment is encouraging and distinctly worth while. The results reported by different observers vary widely. These differences are no doubt explainable in the class of patients who come under observation and treatment. As might be expected in a disease which involves the parenchymatous tissue so extensively, the earlier the treatment is instituted, the better the chance of improvement. If, on the other hand, the condition has progressed to such an extent that it is necessary to commit the patient to an institution, the chances for improvement are diminished. The increasing difficulty in favorably influencing the disease as it grows older is illustrated in Case XIV.

CASE XIV (R. P.). Was first seen March 31, 1913. Denied primary or secondary syphilitic lesion. In 1903 he had a sore throat which was suspected of being syphilitic in nature. Has had stiffness in arms and legs for ten years. Has had tremor

of the hands for four years, and shooting pains in various parts of the body. Four months ago following a fall he had weakness of the muscles of the left leg and foot. This gradually improved. Patient feels that his mental acuity is diminishing and his memory is poor, especially for names of people. He is much worried over business affairs. His physical examination showed small pupils reacting with only slight excursion to light. Coarse tremor of

TABLE 14

R. P., aged forty-three years. Taboparesis.

Date.	Blood. Wassermann reaction.	Cerebrospinal fluid.				Treatment.	
		Cells.	Glob.	Wassermann reaction.	Gold.	Salvarsan.	Intraspinal serum.
1913							
April 7	++++	47	++	0.4 c.c. ++++	..	0.4 gm.	30 c.c. of 40%
22	++++	7	+	0.6 c.c. ++++	..	0.5 gm.	30 c.c. of 40%
May 6	++++	11	+	0.8 c.c. ++++	..	0.5 gm.	30 c.c. of 40%
20	++++	13	±	0.6 c.c. ++++	..	0.5 gm.	30 c.c. of 40%
June 3	++++	9	+	0.6 c.c. ++++	..	0.5 gm.	30 c.c. of 40%
20	++++	14	+	1.0 c.c. ++++	..	0.5 gm.	30 c.c. of 40%
1914							
Jan. 16	++++	3	±	0.6 c.c. ++++	..	0.5 gm.	
23	++++	4	±	0.6 c.c. ++++	..	0.5 gm.	40 c.c. of 50%
Feb. 5	++++	6	±	..	..	0.5 gm.	40 c.c. of 50%
23	++++	6	±	0.8 c.c. ++++	..	0.5 gm.	34 c.c. of 50%
Mar. 10	++++	6	±	0.6 c.c. ++++	..	0.6 gm.	40 c.c. of 50%
23	++++	5	±	0.8 c.c. ++++	..	0.5 gm.	40 c.c. of 50%
April 6	..	3	−	1.0 c.c. ++++	..	0.5 gm.	40 c.c. of 50%
20	++++	..	..	..	..	0.5 gm.	
27	++++	..	..	..	..	0.5 gm.	
1915							
Dec. 11	++++	16	+	0.6 c.c. ++++	..	0.4 gm.	14 c.c. of 100%
20	++++	42	+	0.6 c.c. ++++	..	0.3 gm.	
30	++++	..	+	0.6 c.c. ++++	..	0.4 gm.	15 c.c. of 100%
1916							
Jan. 7	++++	8	±	0.2 c.c. ++++	..	0.4 gm.	15 c.c. of 100%
29	++++	5	±	0.2 c.c. ++++	..	0.5 gm.	15 c.c. of 100%
Feb. 12	++++	2	±	0.6 c.c. ++++	..	0.5 gm.	15 c.c. of 100%
25	++++	5	±	0.6 c.c. ++++	..	0.5 gm.	14 c.c. of 100%
Mar. 11	++++	9	±	0.6 c.c. ++++	..	0.3 gm.	15 c.c. of 100%
25	++++	10	±	0.6 c.c. ++++	..	0.3 gm.	15 c.c. of 100%
April 7	++++	9	±	0.6 c.c. ++++	..	0.35 gm.	15 c.c. of 100%
May 6	++++	4	+	0.6 c.c. ++++	..	0.4 gm.	15 c.c. of 100%

tongue, arms and legs, slight incoördination in legs. No sensory disturbances. All tendon reflexes are overactive except the tendo Achillis which are absent. Mentally, patient was nervous and depressed, but well orientated. The first course of treatment which was given in a fairly early period in the disease, resulted in a rapid diminution of both pleocytosis and globulin, and in the strength of the Wassermann reaction. He then discontinued treatment, but six months later was pursuaded to return for

another course. At this time there was no increase in cells, but the Wassermann reaction was stronger. Again, as in the first course, treatment favorably influenced the laboratory findings, and again the patient discontinued his treatment voluntarily. He was, however, able to resume his work in a very responsible position. In the fall of 1915 he suffered a sudden attack of mental depression and for a time had to be confined in an institution. Treatment which was again resumed at this time had practically no effect on the strength of the Wassermann reaction in the spinal fluid. Several gold tests at this time showed constantly the paretic type. Patient has again refused to be treated and while on superficial examination he appears fairly normal, still his mental condition is such that he cannot return to his former work.

The diminishing influence of treatment as the disease progresses is still more strikingly brought out in:

Case XV (C. W. C.). On admission, July, 1913, he complained of difficulty in thinking and of aching sensation in the leg which had started seven months previously. A diagnosis of neurasthenia had been made. He was occasionally at loss for a word. The examination showed unequal, dilated pupils, right reacted only slightly to light, left not at all; diminished hearing, no Romberg, no incoördination, sensations normal, deep reflexes sluggish. When patient was admitted provisional diagnosis was paresis, but the symptoms were mainly neurasthenic in character; the later symptoms, however, confirmed the original diagnosis. During the first course of treatment, there was a rapid diminution in pleocytosis, and in the Wassermann reaction in the spinal fluid, so that after four months it required 2 c.c. of fluid to give a positive reaction. After patient had been under treatment for nine months he discontinued it for three months. At the end of this interval there was a definite clinical relapse, patient showing distinct mental exaltation. The Wassermann reaction in the blood had become strongly positive; the spinal fluid showed 77 cells and a positive Wassermann reaction. After two months' treatment there was again a definite drop in the cell count

but not so marked as with the first course. The Wassermann reaction responded more slowly. Again patient discontinued

Table 15

G. W. C., aged forty-four years. Paresis; syphilis, duration?

Date.	Blood. Wassermann reaction.	Cerebrospinal fluid.			Treatment.		
		Cells per cm.	Noguchi globulin.	Wassermann reaction.	Intravenous.		Intraspinal. serum.
1913							
July 17	++++	34	+	0.6 c.c. ++++			
22	++++	..	..	..	Sal.,	0.5 gm.	
29	+++	30	++	0.8 c.c. ++++	"	0.4 gm.	30 c.c. of 40%
Aug. 10	++++	..	..	..	"	0.5 gm.	
18	+++	..	..	..	"	0.5 gm.	
26	+++	..	..	..	"	0.5 gm.	
Sept. 17	+++	5	..	1.0 c.c. −	Neo.,	0.9 gm.	30 c.c. of 50%
Oct. 1	++++	7	+	2.0 c.c. +++	"	0.9 gm.	30 c.c. of 50%
Nov. 13	++++	8	+	2.0 c.c. ++	"	0.5 gm.	30 c.c. of 66%
28	++++	..	..	..	"	0.1 gm.	
Dec. 5 to 1914 Mar. 27	..	..	..	..	Sal.,	9 x 0.5 gm.	
June 29	++++	77	+	0.6 c.c. ++++	"	0.5 gm.	
July 1	++++	65	+	0.6 c.c. ++++	"	0.5 gm.	40 c.c. of 50%
20	+++	57	+	0.6 c.c. ++++	"	0.5 gm.	35 c.c. of 50%
Aug. 3	++	22	+	2.0 c.c. ++++	"	0.5 gm.	40 c.c. of 50%
10	+++	..	..	..	"	0.5 gm.	
20	+++	22	+	2.0 c.c. ++++	"	0.5 gm.	40 c.c. of 50%
Sept. 4	++	15	+	0.8 c.c. ++++	"	0.5 gm.	40 c.c. of 50%
Nov. 23	++++	90	+	0.8 c.c. ++++	"	0.5 gm.	40 c.c. of 50%
Dec. 7	++	36	+	0.8 c.c. ++++	"	0.5 gm.	40 c.c. of 50%
21	++	14	+	0.6 c.c. ++++	"	0.5 gm.	40 c.c. of 50%
1915							
Jan. 19	++	20	+	0.6 c.c. ++++	"	0.5 gm.	35 c.c. of 50%
Feb. 15	..	32	+	0.6 c.c. ++++	"	0.5 gm.	40 c.c. of 50%
Mar. 1	++	12	+	0.6 c.c. ++++	"	0.5 gm.	40 c.c. of 50%
15	++++	13	+	0.6 c.c. ++++	"	0.5 gm.	40 c.c. of 50%
27	..	12	+	0.8 c.c. ++++	"	0.5 gm.	40 c.c. of 50%
April 12	++	10	+	0.6 c.c. ++++	"	0.5 gm.	40 c.c. of 50%
July 20	..	73	++	0.8 c.c. ++++	"	0.5 gm.	40 c.c. of 50%
Aug. 6	..	20	++	..	"	0.5 gm.	40 c.c. of 50%
18	..	20	..	..	"	0.5 gm.	40 c.c. of 50%
Sept. 9	+	28	..	1.0 c.c. ++++	"	0.5 gm.	
23	..	11	..	0.4 c.c. ++++	"	0.5 gm.	40 c.c. of 50%
Oct. 11	..	20	..	..	"	0.5 gm.	40 c.c. of 50%
Nov. 9	+	25	±	0.6 c.c. ++++	"	0.5 gm.	40 c.c. of 50%
22	++++	17	..	0.6 c.c. ++++	"	0.5 gm.	40 c.c. of 50%
Dec. 6	++	15	+	0.8 c.c. ++++	"	0.5 gm.	40 c.c. of 50%
22	±	16	+	0.8 c.c. ++++	"	0.5 gm.	40 c.c. of 50%
1916							
Jan. 1	..	..	..	..		0.5 gm.	
13	..	..	..	..	Neo.,	0.6 gm.	
Feb. 2	..	20	..	..	Sal.,	0.5 gm.	40 c.c. of 50%
18	..	17	..	..		0.5 gm.	40 c.c. of 50%
Mar. 3	..	7	..	0.6 c.c. ++++		0.5 gm.	40 c.c. of 50%
April 8	..	..	..	0.6 c.c. ++++		0.5 gm.	40 c.c. of 50%
21	++++	..	..	0.6 c.c. ++++		0.5 gm.	40 c.c. of 50%
May 6	..	..	..	..		0.5 gm.	40 c.c. of 50%
June 28	++++	20	..	0.6 c.c. ++++		0.5 gm.	40 c.c. of 50%

treatment. After an interval he returned with a relapse to 90 cells in the fluid, the Wassermann reaction remained of the same strength. After 9 treatments the cells dropped to 10, the globulin

remained unchanged, and the Wassermann reaction showed no decrease in intensity. However, the patient was somewhat improved clinically. After another interval of three months without treatment another clinical relapse occurred, as shown by speech disturbance, slightly less capacity for work and definite euphoria. At this time there were 73 cells, globulin reaction stronger, the Wassermann reaction the same intensity. After July, 1915, the treatment was given once or twice every month, but in spite of this there was a progressive downward course in the clinical condition and the cerebrospinal fluid was practically uninfluenced. There were increasing speech disturbances, increased difficulties in writing, weakness in the right leg, occasional feeling of numbness and prickling in the forearm and right leg. Patient attempted to continue his business, but was less capable than formerly. It was never thought necessary to commit him to an institution and he died August, 1916, while on a business trip. The gold curves during the last year of his life were all of strongly paretic type.

These 2 cases are fairly typical of what may be expected in the treatment of paresis. (1) Marked clinical improvement to the extent of complete remission with simultaneous improvement in the condition of the cerebrospinal fluid. (2) Marked or complete remission with practically no improvement in the condition of the cerebrospinal fluid. (3) A stationary condition of the cerebrospinal fluid and a progressive downward course clinically, even though most intensive treatment is being applied. In no case can we accurately prognosticate as to which of these three types of response will occur. Most of the patients, late in the disease, show the tendency to a progressive downward course even under treatment.

What then is the effect of treatment in paresis? In the majority of patients who are treated at an early period in the disease there is an increased number of remissions. As a consequence of this there are longer periods of usefulness, and shorter periods of confinement in institutions. Several observers have stated that where formerly many of the paretics in the insane asylums were

bed-ridden for long periods, now they are helpless for a much shorter time, and the patients are often socially possible until near the time of death.

Patients Clinically not Paralytica Dementia in Whom the Cerebrospinal Fluid Shows Paretic Type of Gold Curve.

With the application of the colloidal gold test to the cerebrospinal fluid, of all patients with cerebrospinal involvement, we are occasionally finding a paretic type of gold curve in all stages of the disease; at least in all intervals after infection. During the past year we have had one patient who within less than a year from the time of his initial lesion showed pronounced changes in the cerebrospinal fluid with a marked paretic type of gold curve. Patients with apparently an exudative lesion, such as Case V, also have given this type of curve in their cerebrospinal fluids, but more frequently the paretic curve is found in the fluids of patients with clinical signs and symptoms of tabes dorsalis. The question naturally arises as to what influence the conditions which give rise to this peculiar type of gold curve may have upon the response to treatment. We have seen that when patients with early paresis give this type of curve that the influence of treatment may be slight and that the curve may be unaffected. On the other hand, a case like Case V with exudative lesions may show a rapid reversal of the paretic curve to a luetic curve. The response of a tabetic with a paretic gold curve in his fluid to intensive treatment is illustrated in Table 16.

Case XVI (F. C.), who was admitted April 3, 1915, infection fourteen years ago with rash. Treatment consisted of pills for one year, inunctions one month. Two years ago hot flashes down arms and legs recurring over periods of two or three days. Six months ago shooting pains in right leg, improvement after massage. Numbness in soles of feet for several months. Ten days ago return of the pain. For two years cold baths have caused him pain where formerly they were enjoyed. Examination showed Argyll-Robertson pupils, diminished hearing, hyperalgesia over front of chest, band of hyperesthesia to cold over lower trunk, pain sensation delayed over legs and lower trunk,

deep sensations all retained, slight Romberg, no ataxia, arm reflexes exaggerated, knee-jerks normal, ankle-jerks much diminished. The first course of treatment was accompanied by a satisfactory diminution in pleocytosis, but there was no effect on the intensity of the Wassermann reaction in the fluid. After discontinuing treatment for four months the fluid Wassermann

TABLE 16

F. C., male, aged fifty-two years. Taboparesis (?); syphilis for fourteen years; lancinating pains for two years.

Date.	Blood. Wassermann reaction.	Cerebrospinal fluid.				Treatment.		Reaction.
		Cells.	Glob.	Wassermann reaction.	Gold.	Intv. sal.	Int.sp. serum.	
1915				Cc.		Gm.	100%	
April 5	++++	20	++	0.6++++	55554 00000	0.3		
19	++++	..	++	..	..	0.3		
May 3	++++	6	++	..	..	0.4	15 c.c.	
17	..	30	++	0.6++++	..	0.35	15 c.c.	
June 5	++++	8	++	..	..	0.4	15 c.c.	
20	++++	2	++	0.6++++	..	0.4	15 c.c.	
Aug. 8	..	6	++	0.6++++	..	0.4	13 c.c.	Vomiting, headache, chill six hours, p. IV.
Dec. 5	++++	10	++	1.0+++	..	0.4	17 c.c.	
1916								
Jan. 15	++++	13	++	1.0++++	..	0.35	16 c.c.	Nausea, fulness in head.
Feb. 12	++++	11	++	2.0++++	..	0.25	15 c.c.	Urticaria following IV.
26	++++	8	+	2.0++++	..	0.3	15 c.c.	Urticaria following IV.
Mar. 18	++++	6	±	2.0++	..	0.3	15 c.c.	Flushing, choking.
April 8	++++	6	+	2.0++++	..	0.4	15 c.c.	Flushing, choking urticaria.
22	++++	20	+	2.0++++	..	0.3	15 c.c.	Flushing, choking urticaria.
May 20	++	9	++	2.0−	11221 00000	0.3	15 c.c.	Urticaria only reaction.
June 3	++++	20	++	..	..	0.3	15 c.c.	Urticaria only reaction.
17	++++	..	..	2.0++	..	0.3	15 c.c.	Urticaria only reaction.
July to Nov. 4	Oct. ±	12	+	2.0+	11111 00000	Hg. sa	l. hypo.	KI.
25	±	..	..	..	..	0.2	..	Urticaria.
Dec. 9	+	..	..	..	..	0.2	..	Flushing, choking.
1917								
Jan. 6	+++	..	..	..	..	0.3	..	Urticaria.
20	±	28	+	0.6++++	11233 21000			

reaction was weaker. This is contrary to what is usually found in paresis. Upon resuming treatment the reaction in the fluid rapidly diminished but the cells showed a tendency to remain above normal in number. The patient has shown marked anaphylactic symptoms during intravenous injections followed by urticaria and dermatitis. During a course of mercury and iodide the condition of the fluid remained the same except that the gold

curve became weaker. Because of only the slight abnormality of the cerebrospinal fluid it was felt that resumption of intravenous treatment alone might be sufficient. The patient, however, has continued to exhibit marked hypersensitiveness to the salvarsan and after three injections has shown an increased pleocytosis, a stronger Wassermann reaction, and a more marked luetic type of gold curve in his fluid. He has, however, shown marked subjective improvement, but practically no change in the physical signs. The difficulty in maintaining the improvement in the cerebrospinal fluid and the original paretic type of gold curve suggests that this patient may follow a course similar to that illustrated in the 2 cases of paresis. Whether the active syphilis can be permanently eliminated only the future will answer.

The rapid rate at which the gold curve may be reversed and the other abnormal elements in the spinal fluid diminished is illustrated by:

TABLE 17

B. J., male, painter, aged thirty-six years. Tabes; gastric crises for eight years; syphilis?

Date.	Blood. Wassermann reaction.	Cerebrospinal fluid.				Treatment.			
		Cells.	Glob.	Wassermann reaction.	Gold.	Intrav. salvar.	Intraspinal serum.	KI, gms.	Hg.
Sept. 2	0	21	+	0.6 c.c. ++++	55554 21000	..	...	50	$HgCl_2$, 8 x $\frac{1}{8}$ gr. hypo.
21	..	32	++	2.0 c.c. ++++	55554 42100	..	15 c.c. 100%		
Oct. 3	0	57	++	2.0 c.c. ++++	..	0.2 gm.	15 c.c. "		
11	0	21	++	1.0 c.c. ++++	..	0.35 "	12 c.c. "		
17	0	13	++	2.0 c.c. +	..	0.3 "	12 c.c. "		
26	0	15	++	2.0 c.c. +	..	0.2 "	15 c.c. "		
Nov. 3	0	17	−	2.0 c.c. ++	..	0.3 "	12 c.c. "		
16	0	11	..	..	..	0.3 "	16 c.c. "		
Dec. 13	0	8	+	2.0 c.c. −	22232 10000	0.3 "	12 c.c. "		
28	0	4	+	2.0 c.c. +++	..	0.35 "	15 c.c. "		
Jan. 11	0	8	+	2.0 c.c. +	..	0.3 "	15 c.c. "		
24	..	0	..	2.0 c.c. ±	11221 10000	0.25 "	15 c.c. "		

CASE XVII (P. J.) was admitted August 30, 1916. He had gonorrhea twelve years ago; no history of primary or secondary

syphilitic lesions. For past eight years attacks of epigastric pains, sharp in character, aggravated by eating, relieved by vomiting. For the past two months, vomiting and pain much worse, suprapubic pain during voiding, occasional incontinence of urine. Examination showed an emaciated man, vomiting almost constantly, bladder markedly distended and inflamed, pupils react sluggishly to light, reflexes normal, only disturbance in sensation are two small areas of hypo-esthesia over midscapula, and two areas of hyperalgesia over anterior chest just external to nipples, and a small patch over left side of epigastrium. After treatment was started the vomiting diminished somewhat, but the attacks would occur two or three times a week. He remained in the hospital until November 4, with slow but steady improvement. Occasional attacks of vomiting. After leaving hospital vomiting became less frequent. There was marked constipation, occasional vomiting while straining at stool. The improvement in the condition of the cerebrospinal fluid has been steady in all respects with a reversal in the type of the gold curve to a luetic type which is also diminishing in strength. The intraspinal treatments were combined with intravenous treatments from the beginning because we felt that the paretic type of gold curve made the prognosis more grave. In fact, because of the constant association of paretic type of curve in paresis we feel that when this condition is present in the fluid of patients in whom other forms of cerebrospinal syphilis are thought to be present, the most intensive treatment should be applied from the beginning, and that our prognosis as to ultimate permanent arrest should be guarded. The exact influence of this condition in the cerebrospinal fluid is still a matter for investigation.

Summary. In this presentation the various factors considered in classifying the cases are: Time since infection, clinical picture, laboratory findings, and response to treatment. The following groups are recognized:

I. Early meningitis.

(*a*) Cases which respond readily to the general administration of salvarsan and mercury.

(*b*) Cases which respond more slowly to salvarsan intravenously, and tend to relapse when salvarsan is discontinued, or mercury is substituted.

(*c*) Cases which do not clear up under most intensive general treatment, but which respond satisfactorily to intraspinal treatment.

II. Later forms of central nervous syphilis of the exudative type. The abnormal elements in the cerebrospinal fluid usually disappear rapidly under general administration of iodides, mercury and salvarsan.

III. Tabes dorsalis.

(*a*) Cases which show a rapid response to general treatment.

(*b*) Cases which show no improvement or very slow improvement under general treatment.

(*c*) Cases which show a satisfactory response to intraspinal treatment alone.

(*d*) Cases which have responded slowly to general treatment, but which respond more rapidly when intraspinal injections of "autosalvarsanized serum" are given.

(*e*) Cases which relapse when treatment is discontinued.

(*f*) Cases which continue to improve when treatment is discontinued.

IV. Paralytica dementia.

(*a*) Cases with marked improvement in both clinical signs and the condition of the cerebrospinal fluid.

(*b*) Cases with marked clinical improvement but no change in the cerebrospinal fluid.

(*c*) Cases with progressive downward clinical course and stationary condition of the cerebrospinal fluid.

V. Patients clinically not paralytica dementia in whom the cerebrospinal fluid shows a paretic type of gold curve.

(*a*) Cases which respond rapidly to combined intravenous and intraspinal treatment.

(*b*) Cases which respond more slowly and show a decided tendency for the abnormal elements to recur when treatment is discontinued.

Conclusion. Before undertaking the treatment of a patient with any form of cerebrospinal syphilis, it is important to determine what symptoms are due to inflammation or exudation and what ones are due to degeneration of tracts or cortex. It is also advisable to determine the intensity of the irritative condition as indicated by the cerebrospinal fluid. In general the lesions due to inflammation or exudation are much improved or eliminated by the general treatment of the patient. Those due to degeneration are little, if any, effected. Treatment should be directed not only toward the elimination of symptoms, but toward the elimination of the underlying process, namely, syphilis. In most patients with early meningitis and in those with what was formerly termed tertiary syphilis of the central nervous system, the symptoms due to exudation respond in a satisfactory manner to the general administration of salvarsan, mercury, and potassium iodide. Occasionally, a case is met in which intraspinal treatment seems to be necessary in order to eradicate completely the central nervous lesions. Likewise in tabes dorsalis, many cases respond satisfactorily to the general administration of salvarsan and mercury. On the other hand, in a considerable number of tabetics, the addition of intraspinal injections of serum to intravenous treatment with salvarsan seems to hasten the elimination of abnormal elements in the cerebrospinal fluid and lead to a permanent arrest of the degeneration. It is advisable to continue the treatment of patients with cerebrospinal syphilis or tabes dorsalis until the cerebrospinal fluid is normal and remains so. A possible exception may be made in reference to excess globulin, for an increased globulin is not infrequently found years after all other abnormal elements have disappeared from the fluid.

In paralytica dementia, while much benefit may be expected in increasing the number and length of remissions, the ultimate hope for recovery is slight. When a paretic type of gold curve is found in the fluid of patients in whom the clinical diagnosis of paresis is not justified, the most intensive form treatment should be instituted from the beginning. It is probable that the finding of this paretic type of gold curve often helps us to make a diagnosis

of paresis before clinical symptoms of the disease are present. This early diagnosis with consequent early treatment may be of extreme importance in preventing the development of the outspoken condition. Finally, treatment must be individualized, given in courses, and the condition of the fluid determined at the end of each course and at the beginning of the subsequent course. In this way the indication for kind of treatment as well as the manner of response is much more certainly determined than if we depend on clinical symptoms and objective findings alone.

SYPHILIS OF THE NERVOUS SYSTEM IN SOME OF ITS CLINICAL AND PATHOLOGICAL MANIFESTATIONS[1]

By WILLIAM G. SPILLER, M.D.

It is my[2] opinion that in tabetic ocular palsies, as well as in those recognized as syphilitic ocular palsies, the lesion is not primarily nuclear but is in the nerve fibers as they leave the brain, and I have reported a case of tabes with intense ocular palsies in which the microscopic findings gave much lymphocytic infiltration of the ocular nerves. I am not prepared to state a conviction that primary nuclear palsy of the cranial nerves in tabes is impossible, but I do believe that most tabetic cranial nerve palsies are primarily radicular, and that when nuclear changes are found in tabes they occur in cases of long standing. It is to be expected that when nerves have been degenerated near their nuclear origin during a period of years the nerve cells from which these degenerated fibers arise should show alteration. This view-point is of therapeutic as well as pathological importance, for if the degeneration be in the nerve we may expect recovery from persistent antisyphilitic treatment, provided the degeneration be not too intense and the treatment be begun early; whereas we may expect much less improvement if the cells of origin be primarily affected.

There are cases in which syphilitic ocular palsy is not caused by basal meningitis but by softening implicating the nuclei or nerve fibers of the affected nerve, and a case of bilateral softening forming two separate foci in the oculomotor nuclei I[3] described in 1913.

[1] Read February 7, 1917.
[2] Spiller: Jour. Nerv. and Ment. Dis., January, 1915, p. 15.
[3] Spiller: Le Névraxe, 1913, xiv.

It is well known that tabetic palsies often disappear, and this subject was discussed by Posey[1] in a symposium on the "Neuro-ocular Symptoms of Tabes" in April, 1915. He stated that it is an almost constant experience that the palsies that appear in the early stages of the disease vanish after periods of persistency ranging from but a few hours to two or three weeks; and while it is true that the palsies that occur in the later stages are, as a rule, permanent, even these may be transient and may totally disappear, usually after a longer period than when they are observed at the commencement of the disease.

Posey found that the palsies vanished for a time, at least in perhaps 90 per cent. of the cases which he had under observation. This percentage was based on an analysis of the history of 60 cases taken from his own records and from the study of 28 cases of advanced tabes which he had at one time made in the wards of the Philadelphia General Hospital.

The tendency of the palsies to recur was also dwelt upon, either the same muscles being repeatedly palsied or the paralysis appearing in one or more muscles shortly after it had disappeared in a muscle governed by the same nerve. In some cases the palsy may pass away in a few hours; in others it may persist for years. This return of the muscle to its normal even after years of paralysis he thought should be recognized by ophthalmic surgeons, and should tend to discontinue operations on the eye muscles of tabetics. Tabetic palsies are usually dissociated. This is essentially true when the palsy appears as an initial symptom.

It is important to determine how long an ocular palsy in cerebral syphilis may persist and yet have a final recovery. An interesting case from this point of view is the following: Oscar T., aged thirty-two years, was referred from Dr. de Schweinitz's service April 11, 1914, to the neurological department of the University of Pennsylvania with the note: "Complete palsy of the left external rectus muscle; pupils 3 mm.; no fundus changes; light reaction of pupils gone; faint convergence reaction."

[1] Pennsylvania Med. Jour., October, 1915, p. 55; Jour. Am. Med. Assn., April 16, 1910.

The man contracted syphilis at the age of twenty years.

The symptoms began three weeks before he came to the hospital, with dizziness, and this was soon followed by rapidly developing diplopia. He had headache of moderate intensity, tinnitus in the right ear, paresthesia in the lower limbs, and a sense of constriction about the knees. Station and gait were normal. The patellar reflexes were normal, but the Achilles reflexes were lost. He had no disturbance of the bladder and no disturbance of sensation, even in the distribution of the lower sacral roots. Slight outward rotation of the left eyeball was observed May 6, 1914.

The next note made was on December 24, 1914: "Ocular palsy seems less than it was eight months ago." He was taken into the hospital on this date. He had diminution of pain sensation in the first and second divisions of the right fifth nerve. On December 29 Dr. Langdon reported: "Central vision normal in each eye and fields of vision normal for form and color, although disks show some pallor in temporal portion. No other fundus changes. O. D. pupil 4 mm. O. S. 3.5 mm. Both Argyll-Robertson."

Dr. Butler found the hearing apparently normal.

The Wassermann reaction was negative. He was given the protiodide of mercury, gr. $\frac{1}{3}$.

February 14 and 15 the note was made that the motion in the left eye was gradually returning. February 24 the external rectus palsy had almost disappeared. March 4, Dr. de Schweinitz found concomitant squint was about 15 degrees; the left external rectus now moved the eye to the outward commissure by 33-degree prism base out.

Slight improvement began soon after the patient first came under observation, but the restoration had not amounted to much ten months after the onset of the palsy, although the man had been treated for syphilis at another hospital. Then the improvement advanced rapidly. At the present time there is only slight ocular palsy.

Another case of long-standing ocular palsy with final recovery occurred under the observation of Dr. de Schweinitz, as shown in a letter from him March 5, 1915: "Referring to our conversation

in regard to the recovery of long-standing palsies of the exterior ocular muscles, I have to say that the patient concerning whom I spoke to you is a woman, aged fifty-eight years, whose eyes I have known since the middle of November, 1892, correcting them at stated intervals for a varying hyperopic astigmatism. February 24, 1914, she came with a history of three weeks of diplopia and much left-sided neuralgic pain. She was excessively nervous; there were no nasopharyngeal troubles; no history of rheumatism. Urine examination was negative, but both the Wassermann and the Noguchi reactions were positive, the examination having been made by Dr. Corson White. The left external rectus was the muscle involved, and no other exterior ocular muscle was affected. The palsy was not quite complete, and the diplopia neutralized by a 25- to 30-degree prism base out. I knew that she had been under the care of a man who has a sanitarium, and asked him for some data. He tells me under date of April 18, 1914, that five years previously she had been under his care in his sanitarium because 'her family feared insanity.' He then goes on to say: 'I found no signs of mental unsoundness, and the patient recovered rapidly in about a month's time. I ascribed her condition at that time to the nervous phenomena which follow the menopause.' This paresis of the left abducens remained practically stationary; in point of fact, for the first few days it increased so that there was practically no movement outward. I say 'practically' there was, perhaps, 1 mm. of movement on strong efforts at abduction, and the diplopia could with difficulty be neutralized with very high prisms between 40 and 50 degrees. At first a mixture of iodide of sodium and aspirin was tried. This was soon stopped and iodide of potassium and bichloride of mercury were ordered. There was practically no improvement until about the middle of August of the same year—that is, six months after treatment was begun—when the diplopia became less marked, the neutralization first requiring between 25 and 30 degrees of prism and then between 15 and 20 degrees, and the movement of the eye was slightly improved, the first record of increased movement being on August 12, 1914. During all this period of time, with the exception of the first week, she took very large doses of iodide

of potassium, never less than 90 grains a day, and sometimes as much as 100 grains a day. Between August 12 and December 9 the diplopia remained practically stationary, neutralized by a 15- to 18-degree prism. Indeed, this condition of affairs did not alter materially, maybe only 2 or 3 degrees, until January 7 of this year, when the diplopia had dropped to 7 degrees, and at the last examination, on April 10, was not noticeable, although it could be developed by a red glass, and the movement of the eye was practically normal."

The cause of such palsy, as already said, is usually basal syphilitic meningitis, as illustrated in the following case, which is like the one described by me in 1915:

J. H., aged fifty years, entered the service of Dr. Solis Cohen November 17, 1914, having pneumonia, and died November 29, 1914. He was delirious and consequently a thorough examination could not be made. He had ptosis of the right upper eyelid, the pupils were unequal, and the right was larger and did not react to light. There was obliteration of the lines of expression. In May, 1914, the note was made that he had partial ptosis of the right upper eyelid, the right pupil was larger than the left and irregular, and did not react to light or in accommodation. The right eyeball was rotated outward. He had almost a complete right oculomotor palsy, as he had very slight movement of the right eyeball inward, upward or downward. The left iris did not react to light but did in convergence. The movements of the left eyeball were normal. The oculomotor palsy had developed rapidly a year and a half previously. He was able to count fingers readily with either eye, and examination of the eye-grounds revealed nothing abnormal. He was brought to the hospital because of the ocular condition. He did not comprehend questions readily, was somewhat confused as to time and place, and his memory was feeble. The patellar reflexes were absent.

The microscopic examination in serial sections of the cerebral peduncles showed moderate infiltration of mononuclear cells in the pia at the exit of the oculomotor nerves and disappearance of many nerve cells in the oculomotor nuclei. The origin of the ocular palsy was probably the syphilitic basal meningitis. The posterior columns

in the lower part of the medulla oblongata were degenerated as in tabes, and the case was evidently one of tabes, although the spinal cord was not obtained.

Stargardt[1] investigated the causes of optic atrophy in tabes and paresis in 25 cases, and examined the visual system from the external geniculate body to the retina. When the optic nerve was normal the retina also was normal. Where changes occurred in the retina they were secondary to changes in the optic nerve and differed in no way from those observed after division of the optic nerve or compression of this nerve by a sclerotic internal carotid artery. The cause of the optic atrophy was exudative processes in the chiasm and the intracranial portion of the optic nerves. The optic tract and external geniculate body showed only secondary degeneration. In cases of partial optic atrophy the atrophy was the result of partial infiltration of the intracranial portion of the optic nerve. He concludes that there was no ascending atrophy from any intoxication of the ganglion cells of the retina, as has been assumed. In all cases of optic atrophy he found infiltrative processes in the parts about the chiasm and the optic nerves. The changes in the optic nerves therefore resemble those in the nerves supplying ocular muscles.

It has been my custom for years in studying syphilis of the brain in the laboratory to examine especially the cerebral peduncles and optic chiasm, because if there are manifestations of syphilis in the brain it is here especially we may expect to find lesions. It is because this region of the brain is specially liable to be affected by syphilitic lesions that syphilis may cause the symptoms of tumor of the pituitary body.

I have seen several cases of complete bilateral isolated paralysis of the seventh nerve in syphilis with recovery, and two such cases observed in my service are reported in a paper by Harvey W. Ewing.[2] The lesion must be an infiltration of mononuclear cells in the pia, but it is indeed strange that two nerves of similar distribution, but remote from one another in origin, should alone be picked out by the syphilitic lesion. I have also seen implication of the fifth nerve alone, and reported such a case with necropsy with Camp.

[1] Allg. Ztschr. f. Psychiat., 1912, lxix, 735. [2] Jour. Am. Med. Assn., May 9, 1914.

It is desirable to remember that permanent results were accomplished in the treatment of nervous syphilis in some cases before the days of salvarsan and the modern laboratory methods of investigation. Unfortunately, we must confess that our modern methods, while usually of great value, are not satisfactory in all cases of nervous syphilis, and that some cases do not respond to any treatment, and others may respond and then relapse. I have had the opportunity recently to reëxamine a man who, in 1897, was in the service of Dr. James Hendrie Lloyd[1] at the Philadelphia General Hospital, and whose case was reported by Dr. Lloyd at that time.

The man then was twenty-one years of age, and had a history of syphilis. His symptoms of syphilitic disease of the nervous system were pronounced, and he improved greatly under the administration of mercury, and possibly iodide, and has remained in this improved condition during nineteen years. At present this man is in very fair condition; he has gained flesh, and aside from his polyuria and third-nerve palsy, which he has had since 1897, he has few signs of disease. He is employed as a workman in the Philadelphia General Hospital. I am unable to obtain any information that salvarsan or neosalvarsan had even been used in his treatment, and certainly his improvement and present condition were obtained before the recent methods of treatment were discovered, and there has been no serious relapse during a long period of years.

Syphilis affects not only the outer covering of the brain but also the lining of the ventricular spaces, and may produce intense lesions here. Proliferations of the ependyma may be great, and the aqueduct may be occluded in the same way as frequently is one of the brain arteries, and in this manner hydrocephalus may result. I have observed hydrocephalus confined to one posterior horn of a lateral ventricle or confined to the lateral ventricle of one cerebral hemisphere. A recent case in which hydrocephalus was confined to the posterior horn of one lateral ventricle occurred in the service of Dr. Mills. In studying the cause of this enlargement I found that

[1] Diseases of the Cerebrospinal and Sympathetic Nerves, Twentieth Century Practice.

syphilitic adhesions had formed in the middle of the ventricle, blocking off the posterior horn from the remaining ventricles.

W. H. entered the hospital June 10, 1913. He had been having left-sided headaches for six weeks, but had had right-sided convulsions nineteen years. The right retina was slightly swollen and the arteries were smaller than normal. The right field for white was slightly contracted. The left iris reacted very slightly to light; the left retina was swollen so as to make the edges of the vessels not so well defined as normal. The arteries were small, the veins larger than in the right eye. The left field for white was greatly contracted.

In July, 1913, left-sided symptoms had developed. Saliva dribbled from the left corner of the mouth, and the left side of the face showed paralysis, the left upper limb was weaker than the right, and patellar and Achilles reflexes were prompter on the left side, and the gait was that of left hemiparesis.

Dr. Holloway, about July 11, 1913, found there was no hemianopsia, but there was a tendency for deviation of the eyes to the right. It would seem as though this might have been because of defective vision in the right fields, especially as the patient's condition was such that accurate visual tests could not be made. Death followed an operation on the head. The necropsy was made July 24, 1913.

The examination showed much lymphocytic infiltration of the pia about the optic chiasm and at the base of the brain. The posterior and inferior horns of the left lateral ventricle were much dilated, but the anterior horn of this ventricle was of normal size. The right lateral ventricle was normal. Adhesions in the left lateral ventricle near the foramen of Monro doubtless were the cause of the occlusion of the posterior horn of this ventricle, and probably were of syphilitic origin. An area of softening was found in the outer part of the right lenticular nucleus extending into the brain upward, and probably was the cause of the left-sided symptoms of late development. The cortex about the outer part of the dilated left posterior horn was not over 2 mm. in thickness at its narrowest part, and it is difficult to understand why right lateral homonymous hemianopsia was not produced.

Considerable infiltration of mononuclear cells in the pia of the medulla oblongata and chiasm and thickening of the vessels in the pia of the chiasm were found.

There are cases of syphilis with intense infiltration of mononuclear cells in the pia, such as is the common finding in nervous syphilis, and yet the clinical manifestations cannot be distinguished from those of tabes. Such a case is the following: A man, W. F. P., aged sixty-one years, was in my service at the Philadelphia General Hospital, and died there in 1911. He had a chancre when nineteen years old. About twenty years before he came under my observation his symptoms began with severe shooting pains in the lower limbs, and he became obliged to use a cane in walking. His eyesight began to fail about fifteen years before his admission to the hospital, and in about seven years he became blind. He had dribbling of urine. The Wassermann reaction of the blood was positive. The irides did not react to light, but did in convergence. He had loss of patellar reflexes, ataxic gait, diminution of touch and pain sensations, gastric crises, etc. It is not surprising that others as well as I regarded this case as a typical one of tabes.

The findings were intense infiltration of mononuclear cells in the pia of the spinal cord and of the chiasm and optic nerves, as well as of the chiasm itself. The optic nerves were intensely degenerated. Degeneration was seen in the posterior columns of the cord.

In tabes, as a rule, the infiltration of mononuclear cells in the spinal pia is slight, but death usually occurs late in the disease, and it is possible that the infiltration may have been pronounced in the early stage of the disease.

Of much clinical and pathological significance is the association of syphilis of the central nervous system with other lesions of this part entirely independent of the syphilitic process. I have reported a case in which I had made the diagnosis from the symptoms of tabes associated with syringomyelia, and the necropsy confirmed this diagnosis. A similar case had previously been reported by Schlesinger.

Recently, I[1] reported at a meeting of the Philadelphia Neuro-

[1] Spiller: Pennsylvania Med. Jour., November, 1916, p. 128.

logical Society a case in which the lesions of grave anemia of the spinal cord were associated with those of tabes.

In a symposium held at a meeting of the Philadelphia County Medical Society, September 27, 1916, I referred to the probability of certain cases of epilepsy having an origin in congenital syphilis, and mentioned that the examination of the family of a patient may indicate that the patient probably has congenital syphilis. I think it is well to repeat here verbatim the words used on this subject at that meeting. A brief report of this symposium has been published:

"Probably no one will dispute that syphilis may produce epilepsy, but there are some cases of epilepsy in which syphilis may only be suspected and not proved. I refer to cases in which a father has had a chancre before the birth of his child and the child becomes epileptic. Such a case has recently come under my observation. A man, aged twenty-seven years, has been epileptic since the age of seventeen years, and no cause can be determined. He had no convulsions in childhood, no severe head trauma, but the statement is made by the father that he had an initial lesion about twenty-three years before the birth of the son. The son shows no evidence of syphilis, his blood Wassermann is negative, and yet congenital syphilis may be the cause of the epilepsy. An elder brother had the notched teeth of hereditary syphilis."

Stoll[1] has published recently an interesting paper on "Hereditary Syphilis as a Cause of Chronic Invalidism," and states he judges that the diagnosis of hereditary syphilis by intensive familial study is not generally practised, as no mention was made of it in four symposiums which he recently attended in which many well-known syphilologists discussed the various problems of syphilis.

The subject of syphilis is a broad one, and many interesting features of this disease must of necessity be omitted in every symposium. I do not doubt that if the importance of family infection had been mentioned in these symposiums much information would have been forthcoming. It is certainly not rare for a physician to examine the near blood relatives of a patient with either con-

[1] Jour. Am. Med. Assn., December 23, 1916.

genital or acquired syphilis. Much has been written on congenital syphilis, and one would be remiss in his examination if in a case of suspected congenital syphilis he failed to investigate the patient's family.

Epilepsy is definitely caused at times by acquired syphilis, and it may be possible to trace the relation of cause and effect. In other instances of epilepsy the syphilis remains unrecognized. The Wassermann reaction may be negative, as it frequently is, when syphilis of the nervous system is of very chronic type. The following case, occurring recently in my practice, is illustrative of this point of view. A man, aged thirty years, began to have epileptic attacks at the age of twenty-five years, in the form of petit mal occurring at long intervals. Six brothers and sisters of the man were healthy, and there was no epilepsy in the family. He had been much exposed to syphilis, but had no knowledge of venereal disease. The Wassermann test of the blood was negative. In examining this man for symptoms of organic disease I found that he had delayed micturition; for a long time he had been unable to pass the urine unless the desire was very great, and he would stand for two to five minutes waiting for the urine to flow; he had lost sexual desire. The biceps and triceps reflexes were absent on both sides, the left patellar tendon reflex was very feeble, the right almost lost, and the Achilles reflexes were very weak.

There was not enough here to justify a diagnosis of syphilis, but there was enough to arouse a suspicion of this disease, and I urged the investigation of the spinal fluid and the cautious administration of mercury should the laboratory findings of the fluid be positive or even negative, because the infrequency of the attacks indicated a very chronic process compatible with negative laboratory findings.

It is often stated that syphilis of the central nervous system is a diffuse process implicating both brain and spinal cord. This usually is a correct statement. In a discussion on syphilis at the last meeting of the Congress of Physicians and Surgeons in Washington I called attention to the occurrence of focal syphilis of the central nervous system, in which the symptoms indicate that the lesion is confined to a very limited area. One of the most striking examples of this

is a case of focal myelitis reported by me[1] in September, 1908. At that time we did not have the laboratory technic for the detection of syphilis we now possess. The occurrence of frequent attacks of "rheumatic pains," especially in the lower limbs, inequality of the pupils, loss of pupillary reaction, and a miscarriage at the fourth month suggest syphilis.

The case was one of hemiplegia. The muscles of the neck were rigid and voluntary movement of the neck was greatly impaired. Pain in the neck had been present about five weeks. Paralysis and rigidity of the muscles of the neck in hemiplegia are very extraordinary.

Microscopic examination showed small hemorrhages and swollen axis-cylinders in the third cervical segment. The small vessels in the cord had greatly thickened walls. Lymphocytic infiltration was found within the cord, and the nerve cells of the anterior horns were altered. The cord was less severely affected at the fourth cervical segment, and was about normal at the fifth cervical segment.

Usually when syphilis appears to be focal, careful examination will show further evidence of the disease, as in the two following cases:

Mrs. S., in September, 1915, complained of pain in the left buttock and left groin, and this pain became sharp and shooting in the left thigh. In March, 1916, the left lower limb began to be weak. In June, 1916, pain was noticed in the right lower limb, and at that time there was some rectal and vesical incontinence. When examined in July, 1916, the thighs and legs were distinctly wasted, the right lower limb could be raised easily from the bed, but the left limb could not be raised from the bed or flexed at the knee, although movement of the toes was retained. Passive flexion of the left knee caused great pain. Sense of position was much impaired in the toes of each foot. Tactile, pain, heat, and cold sensations were almost lost in the distribution of the left first and second lumbar roots, and were diminished in the distribution of the twelfth thoracic and third lumbar roots. The patellar reflex was diminished

[1] Spiller: Jour. Nerv. and Ment. Dis., September, 1908.

on the left side and increased on the right side. Persistent ankle-clonus was present on each side. Lumbar puncture yielded a light green fluid, coagulating within two or three minutes, as in the Nonne-Froin syndrome. The cell count was 5. The blood Wassermann was strongly positive.

The symptom-complex was clearly that of a lesion on the left side of the lumbar cord, implicating the 12th thoracic and the 1st, 2d, 3d and 4th lumbar roots, and later the right side of the cord, probably by pressure. On account of the focal character of the symptoms I requested Dr. Frazier to perform an exploratory operation, and this he did. The dura showed a white opacity at the level of the first lumbar vertebra, and the tension was considerable, and the cord at this region was enlarged. The operation caused a complete cessation of the pains in the lower limbs.

In December, 1916, the woman was able to flex and extend the left lower limb, partially at the knee; both patellar reflexes were slightly exaggerated, and there was much more power in the left lower limb than there had been before the operation. She had received antisyphilitic treatment.

While so far this appears as a sharply focalized syphilitic lesion, information was elicited that before the symptoms began in the lower limbs there had been pains of short duration in the upper part of the left upper limb and in the left chest. This indicated that the process was a diffuse one.

In another case the patient, Mrs. P., about two years previously began to have sharp pains in the anterior part of the left thigh, and in about two months this pain yielded to numbness in this region. There had been also some numbness in the right hip. The patellar reflex was absent on the left side and diminished on the right side. The Achilles tendon reflex was absent on each side. Touch, pain, heat and cold sensations were lost in the anterior part of the left thigh. The blood Wassermann was strongly positive.

Here also was a case of focal syphilis, similar to that in the case just recorded, but further examination showed that headache had been severe, that diplopia and ocular palsy were present, and that paresthesia existed in the lower lip.

DISCUSSION ON THE PAPERS OF DRS. FORDYCE, SWIFT AND SPILLER

Dr. F. X. Dercum: I am much pleased that Dr. Swift has spoken of the distinction between syphilis of the vessels and membranes, the so-called exudative or gummatous form, and syphilis of the nerve substance. This is a most important distinction, and one which accords with our clinical experience. I am inclined to believe that we have to do with two strains of spirochetes which produce different results in the organism. Clinical experience confirms this idea. For instance, a case that develops tabes or paresis presents, as a rule, a history of few or no secondaries. It is a common fact also that we elicit the history of the initial lesion with great difficulty, and sometimes we do not get it at all; possibly because a large Hunterian chancre is infrequent in this form. I was also interested in Dr. Swift's statement concerning the injection of the patient's own serum into the spinal canal. Some two years ago the late Dr. Thomas B. Early and myself made a number of similar observations. From simple drainage also striking effects have been obtained. My chief of clinic, Dr. Gilpin, originally suggested this procedure, and especially in tabes the results have almost equalled those in which salvarsan had been used. Of course, we have found that the greatest results were obtained by the intravenous injections of salvarsan and intraspinous injections of salvarsanized serum in selected cases. We have found also that the treatment is most effective if accompanied with a mercurial course in the intervals of the injections. Dr. Fordyce has suggested an interesting thought that in tabes and paresis there is a kind of secondary infection of the nerve tissue from the spirochete in the spinal fluid. It occurs to me that the reason we have such a long interval between the initial lesion and the appearance of the symptoms of tabes, or paresis, sometimes ten to twenty years, is that in all this time the man's defensive reaction has been strong and adequate to his protection. It is only when the ebb of nutrition sets in, *e. g.*, in middle life, that his defences fail and that he breaks down as a paretic or tabetic. This being true, we should continue, with our treatment by salvarsan or iodides, rest and full feeding, employing all possible methods to support the defensive reactions of the organism. We are told that some cases of syphilis are cured spontaneously, and it is not impossible, if this is true, that the organism is able in some instances to overcome by its own defensive reactions the germ of syphilis.

Dr. Charles K. Mills: In the presence of the series of papers so carefully prepared and so well presented, it is difficult, if at all possible, to

make any statements in the discussion which will add to the value of what has preceded. In my private practice and in my large service at the Philadelphia General Hospital in the treatment of syphilis of the nervous system I have had large opportunities of testing the value of both the old and the new therapeutic methods, and I am convinced, with Dr. Schamberg, that it is from the newer methods—the use of salvarsan, neosalvarsan, and other agents by intravenous and intraspinal injection—that we get the best results. Of extreme importance is the statement made by Dr. Fordyce, that by refined laboratory methods we are able to demonstrate at an early period the presence or probable presence of paresis or tabes, even before there is clear clinical evidence, physical and mental, of these diseases. Neurologists see many cases of tabes and paresis which have passed into a practically incurable stage in which, if the probable course of the disease had been discovered sufficiently early, the affection might have been prevented from passing into this degenerative period. It is in diagnosis work of this kind that these newer methods have high value. In the routine treatment of cases at the hospital and elsewhere I have found usually the best results from the combination of salvarsan or neosalvarsan intravenously with the intermediate administration of mercurials, and especially of the salicylate of mercury hypodermically, or with our old-fashioned mercurial inunction.

Dr. H. A. Hare: I should like to ask the readers of the paper what degree of cardiorenal or vascular changes they consider necessitates caution in the use of the intravenous injections? We have been so thoroughly warned in this State by Dr. Schamberg regarding the toxic effect of mercury upon the kidneys that many of us are possibly afraid to use both drugs to the extent that we should.

Another point which would seem to govern the results rests upon the virulence and resistance of the individual organism. This is well illustrated in the different types of the pneumococcus. The virulence of type III is so virulent that our therapeutics fail; while the virulence of type I is very slight; type II occupies a position half-way between the two.

Another point is the development of the parasite of syphilis in different organs of the body for which it has a particular affinity. Rosenow has shown that microörganisms growing in the gall-bladder when injected into animals seek the gall-bladder, and that the pneumococcus growing in the meninges when injected produce meningitis in the animal and do not seem to grow with ease in other tissue. Possibly some similar investigations in regard to parasites of the nature of the spirochete may throw some light upon this point.

Another question, and one which may reveal my ignorance, is in relation to the development of substances deleterious to the parasite by the

injection of the salvarsan into the blood. I understand that Ehrlich recognized that the benefit of salvarsan was not alone due to the quality of the salvarsan itself, but to substances developed in the blood, and I was under the impression that Swift and Ellis attributed their results not so much to the curative effect of the arsenic as to the curative effects of the substances developed in the blood as the result of the intravenous injection.

Syphilographers seem to agree that mercury occupies a position in many instances equal or superior to salvarsan, particularly in the gummatous forms of syphilis; but it has always seemed to me that salvarsan and similar arsenical compounds destroyed the parasite, whereas mercury eliminates the poison and clears up masses of morbid cells.

Regarding the tissue changes caused by mercury, many of those present will remember how Dr. Horatio C. Wood, in describing a case of syphilitic epilepsy due to gumma, said the man would have gotten well if he had not died; his idea being that in many cases of gumma the growth broke down so rapidly under mercury and iodides that the patients could get well. The iodides, on the other hand, have no antiparasitic effect, although they often clear up exudates and other results of the infection.

Dr. William Egbert Robertson: Concerning the value of the iodides in the treatment referred to by Dr. Hare, another explanation seems possible. Dr. Jobling has definitely shown that protein ferment is inactive in the presence of unsaturated fatty acids. As these constitute an appreciable element in the formation of exudates, these latter are immune, so to speak, to the action of protease. Jobling found that iodine will fix free fatty acids, thus mobilizing the ferment, the protease at once proceeding to break down the exudates.

With reference to colloidal gold, which I think was specially called to our attention by Kaplan's paper on Lange's work, the method when detailed as to the preparation yielded such uncertain results that the employment of the test was probably restricted to a relative few. We rarely succeeded more than once out of several trials, and never did develop uniformity until the paper by Miller and his associates appeared. The relative simplicity and uniformity of Miller's method and the delicacy of the test when applied to spinal fluid bespeak for it a rapidly increasing field. We regard it as a more certain test in cases of syphilis of the nervous system than any other laboratory method. Even when the Wassermann has become negative, in many instances the gold solutions will still give a definitely positive reading.

Another point of interest, and one not touched upon, I think, tonight, is the fact that when mercury is given in any form during syphilis, with or without iodides, when these drugs are stopped the disease continues to

progress insidiously, to manifest itself later in some very advanced form, cutaneous, visceral, vascular or nervous, tertiary types. When salvarsan is given intravenously, however, assuming that the malady is only checked and not cured, when it reappears it will do so in that stage at which it was when treatment was undertaken. For instance, secondary manifestations will reappear if the patient was in the secondary phase when treatment was undertaken. In two instances, after but one intravenous injection given during the primary stage, we have seen recurrences of apparently typical primary lesion, in which, after a careful study of the cases, we felt that we were able to rule out reinfection. Further, if our present-day laboratory results are dependable, in those cases giving negative reactions after known positives, we should look for possible reinfection more frequently than before. Such an instance came under our observation within the last year. A physician was infected innocently and shortly after infected his wife. She was promptly treated intravenously, and became negative. At that time the doctor's serum was still 4 plus. A little later she became reinfected and went through the typical phenomena, but later became entirely negative, and has since remained so, as has her husband who has since been treated both intravenously and by mercury.

Comment was made this evening relative to the unreliability of many histories as to the possibility of infection. This need not be purposeful, however, on the part of the patient, for he may have no knowledge of ever having had a primary lesion or even of secondaries. Long ago, Jonathan Hutchinson called attention to the fact that in the event of infection through a punctured wound, no primary lesion results. Such was the case in a physician whom I saw who had very slight evidence of secondaries, without a primary lesion, having received a punctured wound while operating. Two syphilographers failed to recognize the malady because of the absence of the initial sore.

A symptom which I have never seen described, but one which we frequently make use of, in tabes especially, is paresis of the anal sphincter. I should like to ask the readers of the papers whether this symptom has been observed by them. We have seen it as practically the sole clinical evidence of syphilis, which was supported by laboratory findings.

Dr. John A. Kolmer: The subject of immunity in syphilis has been mentioned by Dr. Fordyce and by several of the gentlemen discussing the papers of the evening. I am of the opinion that immunity in syphilis never reaches a high degree. Our experiments show that antibody production in syphilis is not extensive; small amounts of agglutinin for Treponema pallidum may be found in the blood serum during the late stages but we have not been able to demonstrate the presence

of demonstrable amounts of treponemicidal substances in the serum in any stage. The Wassermann antibody is not regarded as a true antibody in the sense of being curative or protective but as a reactionary substance of the body cells. Some immunity probably develops during syphilis but not sufficient to bring about spontaneous cure or, indeed, to protect against reinfection, as shown by Neisser and others in experiments among apes.

I would also like to state that the technic used by Dr. Fordyce and Dr. Swift in conducting the Wassermann reaction with cerebrospinal fluid is very delicate. I am of the opinion that cholesterinized extracts are the most delicate known and large doses of cerebrospinal fluid very materially increases the delicacy of the reaction.

I wish to inquire of Dr. Fordyce and Dr. Swift how much cerebrospinal fluid they collect for these examinations and what criteria they have, if any, for the withdrawal of fluid?

Dr. Jay F. Schamberg: I have listened with great interest and profit to the illuminating addresses that have been presented by the essayists of the evening on the diagnosis and treatment of syphilis of the nervous system. To Dr. Swift is due the credit of having introduced subarachnoid therapy in these diseases. Dr. Fordyce has devoted an enormous amount of time to the refinements of diagnosis and treatment by intraspinal methods. My own experience in the use of these measures is quite limited. I have given, perhaps, fifty intraspinal injections in the treatment of paresis, tabes dorsalis, and cerebrospinal syphilis, employing the Swift-Ellis and Ogilvie methods. My results, to be quite frank, have been most disappointing. These poor results may be attributed in part to the unpromising character of the cases, and in part perhaps to the fact that I did not employ as perfect a technic as that employed by my friend Dr. Fordyce and by Dr. Swift. I am free to admit at least two of these patients died earlier than they would have otherwise done. I mention these facts inasmuch as they represent my honest opinion of the results of the treatment carried out; they do not. of course, bear upon the presentation of fact by Dr. Fordyce and Dr, Swift.

I have had the privilege of knowing Dr. Fordyce for a long time, and I may say that any statement which emanates from him may be taken as scientifically conservative, and one which would command my acceptance without reservation. Dr. Swift's work compels an equal respect.

Dr. Fordyce and Dr. Swift have said that many cases of nerve syphilis do well under the use of intravenous medication. I have had several

cases which have made most satisfactory progress by this method. I have had under my care for six years a man, aged fifty-seven years, with a history of syphilis dating back twenty-five years. He had general rheumatoid pains, an osteoperiostitis gummosa of the tibia, Argyll-Robertson pupils and a 4 plus Wassermann. He has received thirty-one intravenous injections of salvarsan in addition to vigorous mercurial treatment. His pupillary reaction has greatly improved, and he feels absolutely well. He is mentally and physically vigorous, but still has a strongly positive Wassermann. This man comes to see me two or three times a year for a series of intravenous injections. I have the feeling that by this treatment we can keep the disease permanently arrested.

Another patient with beginning tabes, with the usual symptoms improved to such an extent that he was able to resume playing tennis and engage in dancing.

Dr. Fordyce and Dr. Swift have called attention to the fact that if we are to secure really satisfactory results in the treatment of nerve syphilis, vigorous treatment should be begun in the early stages. No one is able to set forth at the present time a prescribed formula for the most approved treatment of syphilis; the present methods of treatment have not been in use for a sufficient length of time. Some of the ultraconservative men do not realize the superior value of salvarsan as compared with mercury. I am glad to note in Dr. Swift's paper that he attributes a distinct superiority to salvarsan over mercury in its effect upon the spinal fluid. We have demonstrated in our laboratory that salvarsan has a distinctly greater selective affinity for the spirochete, and for trypanosomes which react chemicotherapeutically in a similar manner, than is possessed by mercury. Dr. Kolmer has carried out such tests on living cultures of spirochetes *in vitro*. Mercury has a much greater toxicity than salvarsan because of its higher affinity for the cells of the body. From experimental and clinical evidence salvarsan is to be regarded as the premier drug in syphilis, but the value of mercury as determined by many years of employment cannot be ignored. As to the method of administration of mercury, it may be said, in a general way, that the insoluble preparations of mercury are most commonly used. The French have regarded calomel as the most energetic mercurial given by intramuscular injection. The insoluble suspensions of mercury offer the most efficient means of administering the drug in massive doses. They are, however, attended with danger in large doses because of the cumulative storing up of the drug at the sites injected. This opinion is based on laboratory experimentation which we have carried out over a long period of time. The safest method of administration of mercury in massive dosages is by inunction, properly carried out.

Dr. Fordyce (closing): I am glad that Dr. Dercum and Dr. Mills recognize the possibility of development of tabes and paresis in the secondary period of syphilis. If we can demonstrate this hypothesis and after the expiration of a year or two of treatment assure our patient by a lumbar puncture that the fluid is negative and that in all probability he will escape tabes and paresis, a great deal will have been accomplished. Many of our patients have in mind the possibility of the development of these affections, and the mental relief afforded by negative fluid findings is of great importance to their peace of mind. We have seldom had any unpleasant results following lumbar punctures excepting the so-called lumbar puncture headache, which exceptionally persists for a week or ten days even when all precautions are taken. We usually remove not more than 5 or 6 c.c. of fluid which is sufficient for the Wassermann, gold solution and other tests.

The indications for intraspinal medication: Our plan is first to treat our patients with mercury and salvarsan intravenously. If the fluid shows no improvement after this treatment we then employ intraspinal medication. In cases in which the blood is negative and the fluid finding positive we begin our intraspinal treatment without the preliminary intravenous. We also employ intraspinal medication in cases of optic atrophy with positive findings because we consider urgent treatment demanded in such cases. We are now using the combined Swift-Ellis and Ogilvie method; that is, we add to the serum removed from a patient treated intravenously a quantity of salvarsan which varies from $\frac{1}{10}$ to $\frac{1}{3}$ mg. When the cord is involved small doses are indicated on account of the possible danger of producing traumatic myelitis. We consider that this method gives us better results than the method formerly employed.

Dr. Swift (closing): I want to correct the statement that the serum contained 6 mg. of salvarsan. Never does the total serum in intraspinal injections contain as much as 1 mg. of salvarsan. To avoid danger from lumbar puncture, extraordinary aseptic precautions must be observed. In suspected brain tumor one occasionally finds a fatal result following puncture. If brain tumor is suspected we withdraw a very small amount of fluid, about 0.5 c.c. In other cases we take sufficient to make all our diagnostic measurements. We have found that patients given a glass of water every hour following lumbar puncture seem to have headache less frequently. I have selected this opportunity of presenting types of response to treatment, and I have purposely laid emphasis on the response to general treatment. We have been criticized as being advocates of intraspinal treatment alone. You will see from the dates of our observations that we were treating patients intravenously from the beginning, but from the nature of our investigations we have had to lay emphasis

upon certain phases of intraspinal treatment. We believe that many patients do respond satisfactorily to general treatment, and we use mercury, iodides in large quantities, and salvarsan intravenously, and employ intraspinal treatment only if we think it indicated. I believe from our experience that should a patient's cerebrospinal fluid show a paretic type of gold curve we are justified, in agreement with the opinion of Dr. Fordyce, in instituting intraspinal treatment from the beginning. Replying to Dr. Robertson regarding the reflexes of the anal sphincter, I know that some syphilographers recognize the condition as a diagnostic sign.

THE PNEUMONIA SITUATION IN PHILADELPHIA[1]

By DAVID RIESMAN, M.D.

In Philadelphia, during recent years, from one-ninth to one-eighth of all deaths have been due to pneumonia. When we reflect that pneumonia prevails in epidemic form during only a few months of the year, we can see why there should be both in the public and in the medical mind so much apprehension concerning the disease. During the period of its annual height, pneumonia kills from one-fifth to one-fourth of all who die, a fact that stamps it as the most fatal of all the commoner acute diseases. And what is most striking, it has displaced tuberculosis as the cause of the greatest number of deaths from infectious diseases in Philadelphia.

Although in consequence of many coöperating factors, chiefly, perhaps, the ever-increasing efficiency of the city health department, the death rate in Philadelphia has steadily declined from 19.14 per 100,000 in 1906 to 15.61 per 100,000 in 1915, with a slight rise to 16.38 in 1916, yet the total number of deaths from pneumonia in this city has been persistently increasing since 1880. It may be averred that this is a natural result of the growth in population; but in the case of tuberculosis and typhoid fever, notwithstanding the large increase in population, the number of deaths has progressively grown smaller. While in 1908, 1063 persons died in Philadelphia of typhoid fever, only 109 succumbed to that disease in 1915 and 129 in 1916. Nevertheless, the study of vital statistics offers some encouragement. According to the United States census the death rate from pneumonia was 180.5 per 100,000 in 1900. In 1915 it had declined to 132.7 per 100,000,

[1] Read March 7, 1918.

although the latter was higher than the figures for 1912, 1913 and 1914. In the last-named year the rate was 127 per 100,000, the lowest on record.

The records in Philadelphia accord, in the main, with those of the Census Bureau. In 1903 the death rate from pneumonia reached the enormous figure of 232.3 per 100,000, while in 1915 it was 185.69. In 1912 and 1913 it was, however, considerably lower than in 1914, 1915 or 1916. How are we to explain this? When the ancients were confronted with similar mysteries they invoked the vagaries of the genius epidemicus, and they came as near as we do to a correct explanation.

About three-fourths of all pneumonia deaths occur in the winter and spring months; the mortality is lowest from June to November 1. Sometimes December and sometimes January is the worst month, but in several years a very large number of the deaths have occurred in April.

Our Philadelphia statistics distinguish two forms of the disease, lobar pneumonia and bronchopneumonia, the figures of both of these being added to give the total pneumonia mortality. In the statistics there are undoubtedly included a considerable number of cases that are not true pneumonia but forms of tuberculosis and other affections. On the other hand, there are many cases that should be classed with the pneumonias but are not; for example, empyema, some forms of meningitis secondary to pneumonia, pneumococcus septicemia and other aberrant manifestations of pneumococcus infection. Lobar pneumonia is a reportable disease and bronchopneumonia is not, but the custom of reporting the former is not deeply ingrained. It therefore happens that in Philadelphia the number of cases reported is at times smaller than the number of deaths from the disease.

During the winter of 1916–1917 pneumonia seems to have been especially virulent in Philadelphia. Among the many conceivable factors causing this one stands out rather prominently: We have had an unprecedented influx of Southern negroes, many of whom not being used to our climate have contracted pneumonia of a virulent type, which has quickly caused their death.

Another feature of the present epidemic has impressed me, namely, the frequency of multiple cases in the same household. I have known 3 cases of pneumonia to occur in one family in rapid succession and several instances of 2 in one household. Such happenings almost compel the conclusion that there is a strong contagious element present.

To deal with the various questions presented by the pneumonia situation in Philadelphia, Dr. Wilmer Krusen, the Director of Health and Charities, in January, 1916, created the Pneumonia Commission. At its initial meeting the commission divided itself into two committees, one composed of laboratory workers, to whom the scientific problems requiring experimental study were assigned, and the other composed of clinicians, who undertook to study the epidemiology and other general problems connected with acute respiratory diseases, especially the means of controlling their spread. A subcommittee more recently formed has for its function the education of the public in all matters pertaining to respiratory hygiene and the prevention of grippe and pneumonia.

The experimental work was delayed for some months by lack of funds. Finally, however, in June, 1916, through the untiring efforts of Dr. Krusen, the commission received an appropriation of $5000 from City Councils. I want at this time to express to Dr. Krusen the appreciation of the Pneumonia Commission for his valuable coöperation and stimulating helpfulness. It has been a great personal pleasure to all of us to be associated with him in health work.

The laboratory group, the members of which are Drs. Paul A. Lewis, John A. Kolmer, R. C. Rosenberger and C. Y. White, with Dr. A. C. Abbott, a member of the Board of Health, as chairman, has been engaged in research work of various kinds, most of which is ready for publication.

Dr. Lewis is at work on a study of the influence of various antiseptics upon the pneumococcus. Dr. Kolmer has made a study of the effect of chemical solutions upon the pneumococcus in the mouths of healthy persons. The commission was impressed with the importance of this by the observations

of Dochez and Avery (*Jour. of Exper. Med.*, 1915, xxii, 105) that there are many healthy persons who carry disease-producing types of the pneumococcus in their mouths, chiefly persons that have been in contact with pneumonia patients or convalescents from pneumonia. This fact may be of great importance in the epidemiology of lobar pneumonia. Dr. Kolmer, working in conjunction with Dr. Steinfeld, found virulent pneumococci of type 4, virulent for mice, in a number of healthy persons who had not been intimately in contact with pneumonia patients. He was able to disinfect the mouths of these persons completely by having them rinsed with 1 to 10,000 solution of quinin bisulphate, quinin hydrobromide, and quinin and urea, and 1 to 20,000 solution of ethyl hydrocuprein hydrochloride. The solutions were made with 10 per cent. liquor antisepticus, and were used for a minute on three successive days. Drs. Kolmer and Steinfeld will make a fuller report of this work.

In conjunction with the dermatological research laboratory of the Polyclinic Hospital, Dr. Kolmer has undertaken an investigation of chemotherapy in pneumonia. That something may come of this is a consummation devoutly to be wished.

Dr. Rosenberger is studying the pneumonia problems in the Philadelphia General Hospital, identifying the types and investigating the effects of treatment upon the persistence of virulent pneumococci in the blood and sputum after the occurrence of the crisis.

Dr. White has been engaged in the preparation of antitoxic serums. At the city laboratory on the grounds of the Municipal Hospital thirteen horses are under treatment for this purpose. While already there is a considerable quantity of antitoxic serum on hand, chiefly for type 1 of the pneumococcus, a much larger quantity will soon be ready for free distribution to hospitals. The amount will not be large enough for supplying the profession at large with antitoxin for the treatment of private cases. Moreover, there are other considerations that make a promiscuous distribution inadvisable at the present time.

In addition to preparing the antitoxin, the city laboratory,

through the efforts of the Pneumonia Commission, has become fully equipped to identify the type of pneumococcus causing the pneumonia in any particular case, and will do so for physicians throughout the city, free of charge, provided the sputum is sent to the laboratory in a proper state of preservation. Those who are familiar with the rather complicated method by which this identification is made will realize what a tremendous addition to the work of the laboratory this task has involved.

The Clinical Committee of the Pneumonia Commission last spring attempted to make a study of the incidence and mortality of the "grippe," so called, which prevailed with such intensity late in 1915 and early in 1916, and also to learn to what extent men and women in the various occupations were incapacitated by it. These inquiries, together with many others of greater or less importance, were sent out in the form of questionnaires. The commission has also caused to be distributed placards in telephone booths and in trolley cars, urging upon the people the importance of ventilation, the dangers of promiscuous spitting and other sanitary measures.

The Pneumonia Commission has held one special meeting, to which it invited the directors of laboratories and chief resident physicians of all the Philadelphia hospitals, for the purpose of acquainting them with the methods of using the specific serums and the conditions under which these serums would be issued. At this meeting, which was opened by Director Krusen, the scientific basis of serum treatment was explained by Dr. Paul A. Lewis; the results of its use in Philadelphia were reported by Dr. Morris Richardson for the Pennsylvania Hospital and by Dr. Devereux for other institutions. Dr. C. Y. White gave a demonstration of the methods of determining types of pneumococci, and the Chairman laid down the conditions under which the Pneumonia Commission would issue the serum. These conditions are as follows:

1. The identification of the type of pneumonia must be made by the City Laboratory or by a laboratory approved by the Commission.

2. The sputum must be sent in special containers obtainable at the City Laboratory and at certain police stations.

3. The sputum must be sent as early as possible.

4. The injection of the serum must be given by Medical Inspector Devereux, appointed for that purpose by Dr. Krusen; in some cases and in second and subsequent injections the procedure may be carried out by others, but always under the supervision of the inspector.

5. Full reports of the results must be supplied to the Pneumonia Commission.

THE SPECIFIC TREATMENT OF ACUTE LOBAR PNEUMONIA[1]

By RUFUS I. COLE, M.D.
NEW YORK

Specific treatment of a disease is usually understood to mean treatment directed toward the destruction or inhibition of the growth of the etiological agent in the body or neutralization of the injurious substances produced by this agent.

Before a specific treatment is possible, it is usually necessary that something be known of the causal agent. Thirty-five years ago the general features of the common etiological agent in pneumonia were described. But while this knowledge was of importance in making clear our conception of the disease, still more knowledge was required to make specific treatment possible. Inflammation of the lung involving entire lobes may be caused by other organisms than pneumococcus, just as a pharyngitis may be caused by other bacteria than the diphtheria bacillus. Such other organisms carrying lobar inflammation of the lungs are streptococcus, staphylococcus and Friedlander's bacillus, and, in our experience, 5 per cent. of the cases diagnosed lobar pneumonia are due to such organisms. As with diphtheria, moreover, before specific treatment was possible, methods were required for determining in each individual case the organism concerned. Up to a very recent time no effort had been made by clinicians to determine in each case of lobar pneumonia the organism causing the infection. So long as specific treatment is not possible an

[1] Read March 7, 1917.

etiological diagnosis in each individual case is not so important, except from the stand-point of prognosis. As soon as we come to consider the possibility of specific treatment, however, such etiological diagnoses become imperative. As concerns pneumonia the matter is complicated by the fact, discovered first by Neufeld and later more fully investigated by us, namely, that as regards immunity, pneumococci are not all identical, but different races of bacteria show distinct specific differences; one pneumococcus may no more resemble another than a diphtheria bacillus resembles a typhoid bacillus. Morphologically, and in their cultural characteristics, they are all alike, but as regards immunity reactions they may be vastly different.

With our present knowledge, specific treatment of any infectious disease may be of two kinds: First, we may make use of complex chemical substances which have a specific action in destroying the infectious agent, such as quinin in malarial infection, or complex substances such as atoxyl in trypanosome infections or salvarsan in spirochetal infections. These chemical substances do not depend at all for their efficacy on any immunity reactions, and therefore frequently act on groups of closely related organisms. Such a drug effective against pneumococci, therefore, would probably be active against all races, and I shall later speak of such a drug.

The second method of specific therapy makes use of the substances or reactions upon which immunity in the animal depends, and which in pneumonia are undoubtedly responsible for natural recovery from the disease. This method can be effective only if the substances employed are identical with those formed during the reaction with the same race of organisms as that which is responsible for the individual case treated, for immunity reactions are specific in a remarkable degree. As I have stated before, all races of pneumococci are not identical. It has been possible, however, to place many of them in definite groups so that all the members of each group are identical, and therefore for therapeutic purposes it is only necessary in the individual case to determine to which group the organism present belongs. This separation into

immunological groups was done in the following way: A large number of races of pneumococci from cases of pneumonia were isolated. Rabbits were then immunized to each one of these races by repeated injections of dead, then living, cultures. The sera of these different rabbits were then tested against all of the strains. This was done by means of the agglutination reaction and also by studying the protective power of the serum, employing mice for this purpose. It was found that the serum of one rabbit, which we will call Rabbit A, acted against a number of the races, but against the others it had absolutely no effect. Moreover, the sera of all the rabbits which had been immunized to the races against which (A) serum was effective, were effective against the organism (A) which had been used for immunizing Rabbit A. In other words, all the sera and all the organisms of this group mutually reacted, but there were no reactions with the other pneumococci or with the sera produced by inoculation of these other pneumococci into suitable animals. In like manner it was possible to separate a second group of organisms. These two groups of pneumococci we have called Type I and Type II. It was then found that a third group of organisms existed which differed from the preceding two groups, not only in immunological reactions, but in the possession of larger capsules than the others, and in producing very sticky mucous exudates in animals. These have been named Pneumococcus mucosus, and in our classification are included in Type III. Finally, there are a number of organisms which not only do not fall into any one of these groups but differ among themselves; immunologically, each race seems to be perfectly distinct, and so far it has been impossible to make any subdivision of this group on immunological grounds. This group has been called Type IV. It is of interest that these latter organisms are like those found in normal mouths.

These facts in regard to types are of fundamental importance. The specificity of type makes it absolutely essential that the type of organism concerned in each individual case be determined in order that the principles of immunity be called upon to aid in treating the disease. Methods for this purpose have been devised,

and it is now possible to determine the type of pneumococcus concerned in any case within a few hours after the case comes under observation. The method is as follows: A small portion of sputum coughed up from the lung is injected into the peritoneal cavity of a mouse. After the organisms have developed the peritoneal cavity is washed out with salt solution. The washings are then centrifugalized for a short time to remove leukocytes and other animal cells. There then remains a suspension of bacteria. To small portions of this suspension immune sera I and II are added. If agglutination occurs in either mixture we know that we are dealing with the type of organism corresponding to the effective serum. If no agglutination occurs the organisms are of Type III or IV. Type III organisms can usually be detected by direct examination of the peritoneal exudate.

Theoretically, there are at least two ways in which the principles of immunity as now understood can be employed in aiding recovery from pneumonia. First, we can possibly aid in the development of immune bodies in the patient by attempting to stimulate the patient to produce such immune bodies more rapidly and in larger amounts than would be the result of the natural infection unaided. The only conceivable method at present to produce this result would be the administration of vaccines. From experimental studies in the production of immunity, it does not seem likely that in a disease like pneumonia, running a very short course, this method of procedure would be likely to be followed by satisfactory results. A considerable number of attempts to treat pneumonia in this way have been made, not, however, with knowledge of differences of type, and with proper application of this knowledge. We have made certain efforts to cause a very rapid development of immunity in animals, but so far the results have been negative. Moreover, the published results which have been obtained with the cruder methods of vaccine therapy have not seemed to be encouraging, and in the absence of experimental justification we have not pursued the method further.

The second method to be employed is to transfer the immune substances, produced in the serum of experimental animals,

directly to the patient supplying him with immune bodies at a time before he has been able to produce his own immunity reactions. This is the method we have employed. The experimental justification for this method is as follows: If an animal, such as the rabbit, the sheep or the horse, is immunized by the injection of repeated and increasing doses of pneumococci, the serum of this animal acquires the power of agglutinating and to some extent inhibiting the growth of pneumococci of the same type. It also acquires opsonic power. More important than this, however, when a very small amount of such serum is injected into a susceptible animal, such as the mouse, together with a dose of the bacteria which would certainly, without the addition of the serum, cause the death of the animal, the animal, instead of dying, shows no ill effects from the injection. Such small doses of serum may not only protect against one lethal dose of the culture, but may protect against many thousand times the lethal dose. Second, such serum may protect not only when the serum and cultures are injected simultaneously, but if the amount of culture be not too great, and the injection of serum be not too long delayed, curative results may be obtained, even in such susceptible animals as rabbits. Moreover, the development of immune substances in the blood of the patient is probably responsible for his natural recovery. At any rate, studies of the blood of patients have shown that at the time of crisis, or when recovery is occurring, such immune substances appear in his blood, and death of the patient seems to be associated with his failure to form such immune bodies.

It seems logical, therefore, to attempt to aid the patient by the administration of such immune serum. This, therefore, has been our method of procedure.

The immune sera have been obtained from horses. The method employed in immunizing the horses at first was that which is commonly employed in the production of other therapeutic sera, namely, the intravenous injection every seven or eight days of the bacteria, beginning first with killed organisms, gradually increasing the dose, and then proceeding to the injection of living

organisms, at first in very small numbers and later in larger amounts. This is a slow, time-consuming procedure, and the injection of living organisms not infrequently is followed by the death of the horse. Lately we have adopted a new method which seems very promising. In this method only dead organisms are used and the injections are made every day for seven days. Then no injections are made for the following seven days, when the injection of dead organisms, in slightly larger amounts, is resumed. Repeating the method over and over, first seven days of injection, then seven days of rest, increasing the size of the dose each week, it has been possible in a period of six to seven weeks to obtain sera of as great potency as any we have previously obtained using the older methods.

Employing these methods, it has been possible to obtain serum against pneumococcus of Type I, which, as tested in animals, is of very great strength; 0.2 c.c. of such a serum will protect a mouse against as much as 0.1 c.c. or in some cases 0.4 to 0.5 c.c. of a culture, of which 0.000001 c.c. when given alone, without the serum, will certainly kill. A serum has also been obtained against organisms of Type II, but this is of somewhat less potency. By no method have we yet been able to produce a serum against Type II organisms which is experimentally so active as that which we have obtained against Type I organisms. Up to within a very short period we have thought it impossible to produce a serum which could protect mice against organisms of Type III. We, however, only attempted this in rabbits, goats and sheep, and, since our results were negative, did not employ horses for this purpose. More recently, however, the New York State Board of Health, under Dr. Wadsworth's direction, notwithstanding our failure with small animals, proceeded to immunize a horse, and sent us some of the serum, and to our surprise we found not only that it was specifically agglutinating, but that in addition it would protect mice, not in so high multiples of the minimal lethal dose as do the sera of the first two types, but still of sufficient potency to show the production of specific immune bodies is not impossible in this type of infection. Lastly, it is possible to produce an immune

serum against any given race of Type IV, but as such a serum is effective only against the single race used for immunization, such a serum could obviously not be employed for therapeutic purposes.

There have been produced, then, a serum of high potency against organisms of Type I, a serum of less potency against organisms of Type II and a serum of very slight potency against organisms of Type III. So far as the clinical application, therefore, of immune serum is concerned, the question resolves itself into the question of the possibility of serum treatment in cases due to pneumococci of Type I and II. Experimental studies have indicated that such antibacterial sera can only be effective if they are given in large amounts, sufficient to obtain a considerable concentration of the immune bodies in the blood of the patient. Moreover, such sera are much more likely to be effective if they are administered early in the course of the disease before the concentration of bacteria in the body has become too great and before the body has become so affected by the intoxication that death may occur from the havoc already done, even if further growth of the organisms be inhibited. We have, therefore, given the serum intravenously in very large amount and have commenced the treatment as early as possible, so soon as the diagnosis and determination of the type of infecting organism could be made.

So far as infection due to organisms of Type II is concerned our results with the serum have not been very promising. We are now studying the treatment of these cases, not with whole serum, but with a concentrated extract of the serum prepared by a method devised in our laboratory by Drs. Gay and Chickering. This method of treatment of Type II infections is still in an experimental stage and I shall not consider it further at the present time.

As regards results of the serum treatment, I should like today to confine my attention chiefly to the results obtained in the treatment of cases due to Type I infection.

I have placed on the wall a chart showing the incidence of cases of the various types and the mortality in each group when the patients have not received specific treatment. The figures are given in round numbers and are prepared from a study of the

types of organisms in 400 cases of pneumonia observed in the Hospital of the Rockefeller Institute in New York, and in smaller series of cases in Philadelphia, Boston and Detroit hospitals and in the Presbyterian Hospital in New York:

In every 100 cases of lobar pneumonia	
35 are due to pneumococci of Type I.	Of these 10 die.
30 are due to pneumococci of Type II.	Of these 10 die.
10 are due to pneumococci of Type III.	Of these 6 die.
25 are due to pneumococci of Type IV.	Of these 4 die.
100 are due to pneumococci of all types.	Of these 30 die.

It is quite probable that in different places and in different years the results may vary somewhat, but the chart undoubtedly gives an average result and will probably be found to be fairly true of any large series of cases. The total mortality rate also is about that at present obtained without specific treatment in all the large general hospitals. It will be observed that the cases due to Type I and II make up over 60 per cent. of the cases and show the average mortality. The cases of Type III show a much higher mortality but are relatively few in number. The cases due to pneumococci of Type IV are greater in number but have a relatively low mortality, so that the fact that serum treatment in this type of case is impossible and will probably remain so is relatively less important.

While the cases of Type I compose only about a third of the cases of pneumonia, when the very great frequency of pneumonia is considered the possibility of influencing cases of this type becomes of very great importance.

In 1914 the number of deaths from lobar pneumonia alone (not including bronchopneumonia) in New York City was 5145; in 1915, 6086, and in 1916 will probably be greater still for in the month of January over 1100 deaths from lobar pneumonia occurred. Of the deaths in 1914 probably 1800 were due to pneumococcus Type I. This is more than all the deaths from typhoid fever, measles, scarlet fever and cerebrospinal meningitis combined, and almost as many as all the deaths from poliomyelitis occurring in the present epidemic.

The number of cases of Type I infection so far treated with

serum is not large, but the results have been very encouraging. Seventy-two cases have now been treated by this method. Before beginning serum about one-third of the patients died. Of the 72 since serum treatment was commenced, 6 have died, a mortality of only a little over 8 per cent. Moreover, of these 6 fatal cases, 1 patient died late in convalescence from a pulmonary embolism, 1 died on the fifty-fourth day of the disease from a complicating general streptococcus infection, and 2 received serum treatment only when they were *in extremis*.

I realize fully the necessity for conservatism in drawing conclusions as to the efficacy of any form of treatment in lobar pneumonia. However, there have been no apparent differences in the kind or severeity of the cases treated before and since institution of serum treatment. In practically all cases after administration of the serum is commenced there is very quickly an apparent change in the patient's condition. Most important is the fact that when blood cultures before giving the serum are positive, after one dose of the serum they become negative. Furthermore, after administration of the serum no further extension of the pulmonary process has occurred. The local lesion, however, does not immediately resolve and usually there is no immediate onset of a crisis. Apparently what the serum can do is to prevent the growth or distribution of the organisms through the blood and prevent new and further involvement of lung tissue. It is probable that serum has little effect on the tissues actually consolidated, indeed, experiments have shown that the circulation through the center of a consolidated area is so impaired that but little of the serum reaches this region. It seems evident, however, that the intoxication and death in this disease are definitely related to the general infection and to the actively extending process. The fact, moreover, that the experimentally less active Type II serum has apparently no clinical value, makes it certain we are being deceived by an extraordinary coincidence or that, as we now believe, immune serum is very effective in this type of infection, as effective, if not more so, than any of the other curative sera now employed in other diseases.

The amount of serum required has differed in the different cases, depending on the severity. Our plan is to give 80 c.c. and repeat this dose every twelve hours until the temperature and pulse-rate fall. Some cases have received 500 c.c. or even more; in other cases one or two doses have been sufficient. To guard against the administration of serum to patients who are sensitive to such injections, it is our custom to give to all pneumonia patients on admission to the hospital 0.5 c.c. of horse serum subcutaneously in order to desensitize them. By the time the type of organism is determined, in six to eight hours, we have considered it safe to go ahead with the treatment. So far in over 100 cases receiving serum of the various types there have been no alarming or unfavorable results.

A large number of the patients receiving the large doses of serum suffer from serum sickness after a week or ten days. The symptoms, while sometimes distressing, are never serious, and if the serum is efficacious, this disturbance is of course negligible.

I can only speak very briefly of the second possible form of specific treatment, namely, the use of chemotherapeutic substances. Several years ago, influenced undoubtedly by the clinical reports of the efficacy of quinin in the treatment of pneumonia, Morgenroth undertook the study of the action on pneumococci of quinin and also of a number of derivatives of this drug, and he also studied the effect of these drugs on experimental infection in animals produced by the inoculation of pneumococci. He found that quinin indeed has a specific bactericidal action on pneumococci, both *in vivo* and *in vitro*, but that this action is very slight. In studying various derivatives of quinin, however, he found one (called ethylhydrocuprein) which possessed this specific action to a very high degree. Indeed, it was found to be one hundred and fifty or more times stronger than quinine and is able not only to kill pneumococci in the test-tube, even in dilutions as high as 1 to 5,000,000, but with proper dosage may even cure infection in so susceptible an animal as the mouse. This drug may be employed as the base, as the hydrochloride, or lately as the salicylate. It has been manufactured under the trade

name "optochin." If the action of quinin in pneumonia is of the same nature as that of optochin, different only in degree, much credit should be given to the acumen of those physicians who introduced the employment of quinin in the treatment of pneumonia, since the specific action of the latter, judging from the experimental studies, must be very slight.

Dr. Moore, working in the Rockefeller Institute, has shown that the action of optochin is not confined to any one type of pneumococcus, but is equally efficacious against all.

Wright showed that the blood serum of patients who had received optochin by mouth acquires the property of killing pneumococci in the test-tube, and Moore has shown that the blood serum of normal or infected rabbits acquires this property after optochin has been administered. Making use of this fact, and employing proper technic, it is indeed possible to determine roughly the concentration of the drug in the blood of the rabbits to which it has been administered, and in a series of patients in the Hospital of the Rockefeller Institute, Moore and Chesney have used this method in an endeavor to determine the best dosage and method of administration in order to obtain the most favorable results.

Since the introduction of the drug, numerous reports of its use have appeared in the literature. Moore and Chesney have been able to collect the reports of its use in almost 800 cases. The conclusions in regard to its clinical efficacy, however, have been conflicting, some have been favorable, other writers have failed to see any good effects from its use. The methods of employment have varied, however, and no standard dosage has been employed. The study conducted in the Rockefeller Hospital has been on a limited number of patients, and has proceeded from the assumption that the good effects, if there are any, are due to the bactericidal property which the drug possesses. In brief, the study has consisted in very frequent determinations of the bactericidal power of the patient's blood after the administration of the drug. In order to determine the best method of administration, various methods were employed and varying dosages. Very early following the

administration of the drug to man by Morgenroth and others it was found that it might give rise to untoward symptoms, especially affecting the eye and ear. The amount of drug that can be given is, therefore, limited, and this maximum non-toxic dose is not much greater than the probable curative dose as determined by animal experimentation. Therefore the proper dosage of the drug is of extreme importance; if too little be given it will have no effect, if too much it is toxic.

The studies of Morgenroth and of Moore and Chesney have also shown that if the pneumococci are exposed *in vitro* and also *in vivo* to concentrations of the drug not sufficient to kill them they may very quickly become resistant to the drug (or "fast," as it is called), and such organisms require a very much larger concentration of the drug to kill them than do the organisms not having been so exposed. Actual examples of this phenomenon have been seen among the patients treated in our hospital. Without going into the actual procedure employed by Moore and Chesney or the steps taken which have led up to their results, I may say that they have found that for the blood of the patient to acquire and maintain a constant bactericidal power it is advisable that the patient should receive first a relatively large dose of the drug (0.5 gm. for a moderate-sized adult), and this followed by small doses given every two hours or oftener. The weight of the patient is important, and the dose should be regulated so that he receive at least 0.024 gm. of the drug per kilogram body weight every twenty-four hours. On the other hand, it is questionable whether it is safe to give much more than 0.028 gm. per kilogram per twenty-four hours. If the daily dose be divided into only two or three doses, the bactericidal power of the serum is fluctuating and the infecting bacteria may acquire fastness. Moreover, it seems probable that the drug is less toxic when administered in the divided doses. At present it is impossible to say whether all toxic effects will be absent when administered as described. None of our cases when treated in this way have shown any ill effects, though one patient, receiving only the amount recommended per twenty-four hours, but in larger individual doses, did show a severe toxic retinitis, leading

to complete blindness for six days. Function was gradually restored, however, and now after several months the vision is perfect. Among the cases reported by others, 4.44 per cent. have shown varying degrees of amblyopia, though in only one case, so far as I am aware, has the impairment of vision been permanent. In this instance reported by Oliver, 2.4 grams per day were given over several days, and the symptoms were still present seventeen months afterward.

By the method described it has been possible to cause the blood of pneumonia patients to acquire a high bactericidal power and to retain it as long as the administration of the drug is continued. It is quickly lost, however, after the drug is stopped, in some cases within a few hours.

As to the effect on the clinical course and mortality rate, our experience at present is hardly large enough to enable us to express a definite opinion. In all, only 25 of our cases may be said to have been treated according to the method now considered proper. These cases were mostly infections due to Type II and Type III pneumococci, since all our Type I cases are treated with serum. Since the mortality is high in these groups, the fact that 4 out of 25 patients died, making the mortality 16 per cent., is not discouraging. On the other hand, it cannot be said that the results were very striking or brilliant. They are sufficient, however, to warrant a much further clinical study than has yet been given, and now, since we have definite criteria as to dosage, it is our intention, to push the clinical study much further. It is hoped that a proper combination of serum and optochin may give better clinical results than either alone, just as such a combination has done in experimental study.

In this study of the specific treatment of pneumonia results of considerable interest have been obtained. We are apparently much nearer the goal than we were ten or even five years ago. We now know that for treatment based on immunity reaction the type of infecting organism must be known in every case, and we now have methods for determining this. We have a serum that is apparently very efficacious against one of the types of infection.

Furthermore, we are in possession of a drug that has a specific action on pneumococcus and we now have knowledge of the proper methods of administering and controlling the dosage.

We should apply with diligence the knowledge we already possess for the relief of our patients suffering from this dread malady and we propose to continue to seek for further light in order that a specific cure for all cases may be obtained.

CLINICAL ASPECTS OF PNEUMONIA[1]

By M. HOWARD FUSSELL, M.D.

When your committee honored me with an invitation to join in this meeting, I felt it incumbent before this audience that I say something of my personal experience, rather than give a *résumé* of well-known facts, accessible to all. Whatever the value of this presentment, therefore, it will be more or less accurately a statement of my own practises. After listening to the admirable papers, however, I feel that I am a mere runner up, and must recall your attention to well-known facts. First as to

Diagnosis. I hold no brief as to any original means of deciding whether or not a patient is suffering from pneumonia of any type, but wish to reiterate the old time-worn statement that a sufficient diagnosis can be made only (I mean this literally) by a thorough examination of all of the organs. In certain cases the physical signs and symptoms are so pronounced that the case is at once classed as one of croupous pneumonia. But even in these well-marked cases a thorough knowledge of the conditions of the heart, of the kidneys, and the existence of any chronic disease is of the greatest importance, both as to prognosis and the treatment of the disease, and, indeed, as to whether the condition present is really a pneumonia or a manifestation of the chronic disease present.

This care in diagnosis is necessary, particularly because of the similarity of pneumonia to diseases of other organs, particularly of abdominal conditions. We have all of us been in a quandary as to whether a case with severe abdominal pain was one of appendi-

[1] Read March 7, 1917.

citis or other abdominal condition or one of pneumonia. Only extreme caution will prevent an error. The blood count does not help us because cases of pneumonia and cases of abdominal inflammation both have leukocytosis as one of the symptoms. Differentiation must consist in careful examination of both abdomen and chest. Most operations which have been done on cases of pneumonia, mistaken for appendicitis have been the result of an error of omission, consisting in a failure to think of a possible pneumonia in the presence of acute abdominal inflammation and a consequent failure in diagnosis follows. If the rule of examination of all organs in every case were followed, fewer abdominal operations would be done in cases of pneumonia.

Modes of Onset. *Classes.* Cases of pneumonia with chill, cough, pain in the side, and fever attract the layman's attention; they are promptly recognized, and treatment is promptly begun. Other cases, however, in which the disease begins insidiously either as primary cases of pneumonia or secondary to cases of infectious bronchitis are perhaps from a stand-point of treatment more important. Numbers of cases of pneumonia have their beginning in attacks of infectious bronchitis, infective colds, or influenza. Whatever name may be used, certainly we should all be alive to the fact that such attacks which the laity call "la grippe," and which may affect anything of the mucous membranes from the nares to the smaller bronchioles, and which are frequently mismanaged by ourselves, are fertile sources of severe lobar or lobular pneumonia. Every case of infective cold with fever should be kept in bed until they are well. Even while they seem to be improving, examination of the chest should be made in order to note the first onset of a consolidated area.

Abortive types of pneumonia unquestionably exist. An instance seen recently with chill, fever, pain in the side, expectoration of blood-tinged sputum (typical rusty sputum) containing blood, leukocytes, and almost a pure culture of pneumococci, with dulness, crepitation, and friction of the seat of pain. All the symptoms disappeared in twenty-four hours, though the area of lung involvement remained for seventy-two hours, and perhaps longer.

Pneumonia in certain cases of the aged is particularly liable to be overlooked. The reaction to the infection is weak, there is little leukocytosis, and only slight fever. The never-failing rule of careful physical examination is as necessary in the old as in others.

The relation of the leukocytosis in 582 cases at Johns Hopkins Hospital, quoted by Osler, appear to indicate that a high leukocytosis here as in other infections shows one of two things, either that there is a severe infection or a good reaction, or both. A very low leukocyte count means, as a rule, a bad prognosis or a slight infection. The very high and the very low leukocyte count had a high mortality.

The prognostic value of the relation of the height of the blood-pressure to the rate of the pulse, has it would appear to me, been overestimated. In my experience, low pressure expresses, frequently, a severe infection, a high pulse-rate often expresses the same thing. But the pressure may frequently be high and above the pulse-rate in fatal cases. On the other hand I have seen cases with pressure below the pulse-rate in which the patient seemed scarcely ill.

In a case occurring last winter in the wards of the Episcopal Hospital this took place during the height of the disease. After the temperature had reached normal the blood-pressure rose to a point above the pulse rate, and much above the point it was during the acute illness.

Renal Involvement. Perhaps the majority of cases of pneumonia have albumin and tube casts in the urine some time during the course of the attack. Unless the urine be highly albuminous and tube casts of dark granular variety and blood be present this urinary condition does not need to give us any concern. Nevertheless, enough cases of renal involvement of severe type do occur to make it imperative that the urine be regularly examined in order to take what measures seem to be indicated.

The measures of relief which are indicated necessarily apply to the relief of the toxemia, as this toxemia is the cause of the renal involvement. Because the urine of pneumonia contains albumin

and tube casts, especially if these indicate an actual inflammation of the kidney, is *no reason* to fly to caffein, acetate of potash, and other so-called diuretics. Indeed, the very presence of an acute nephritis contra-indicates the use of stimulating diuretics. They should not be used. Water by the mouth, the bowel, the veins or the skin is the best remedy for the toxemia, and hence for the nephritis. I use dry cupping over the renal region and the application of large poultices of flaxseed over the cupped region, in the hope and belief that such will be relieved by these measures.

General Treatment. Notwithstanding the excellent scientific work done by Dr. Cole in the Rockefeller Institute with the specific type serum and the hopeful results he reports, this serum as yet is only for the favored few, both patients and physicians. While it is probably that in view of the fact that a serum of type I group might be used without harm in other types of pneumonia, it certainly is not of value, and the risk of reaction which occurs even with the most scrupulous care precludes its use unless we are aware of the type.

Philadelphia is favored in that it is now prepared to run out the type of pneumococci to supply serum for the types I and II and to have it administered by an expert. Therefore we in Philadelphia are favored. But thousands of cases of pneumonia have no opportunity to even try this scientific treatment, hence the general treatment must be based on common-sense principles. I have said in many other places that the foundation of rational treatment has the basis of early recognition, rest (mental and physical), fresh air, constant watchfulness, good food, and proper medication.

It is sometimes impossible and always difficult to make a diagnosis of pneumonia during the first twenty-four hours of the attack, but whenever the symptoms and physical signs in a given case are suspicious of pneumonia the case should be put upon whatever routine treatment is decided upon. Failure to appreciate the probability of an attack being one of true pneumonia may be followed by orders which will allow the patient to be up and about and to thus become exhausted and allow the attack to be much

more severe. The essentials as outlined are rest, fresh air, food, and watchfulness.

Rest. This must be absolute. Mental rest as well as physical. All unnecessary movement must be vetoed. The patient should not rise for urination or defecation. To this end a bed-pan must be used. Visitors to patients should be distinctly limited. It is better if the patient does not become restless under their restriction to have no visitors at all. If the presence of the wife or husband or any other individual, on the other hand, soothes the patient it will be best for that individual to be admitted to the sick room. But care must be taken that the sick room is not made a visiting place for all friends and relatives. In hospital wards where visiting is not controlled as carefully as in private homes I think it is quite certain that the patients with pneumonia are not quite so well after visits have been made. The rest should continue several days after convalescence has begun. One must remember that the majority of uncomplicated croupous pneumonia cases get well by a crisis. The remainder by a lysis lasts three or four days.

For a week or ten days the patient has been extremely ill and all his forces are weakened. Therefore extreme care must be taken to avoid any unnecessary strain for several days.

After the temperature has remained normal for about one week, provided the patient seems well otherwise, he may be allowed to sit up.

Fresh Air. This means pure, unheated, unbreathed air, admitted into the room through wide-open windows. A room with two windows opposite each other is best so that a cross draft may be formed, this keeping the air in the room constantly changed. The patient need not be placed in the draft, though except for discomfort, it is a matter of indifference whether a draft blows over the patient, provided he be well protected with clothing so that the body will not be chilled. If it is practicable it is still better for the patient to be on an open porch protected so that the wind and storm will not drive over the patient. To the writer's mind the usual direction to keep the temperature of the room between 60° and 70° is a mistake. Under these circum-

stances the temperature of the air in the room should be that of the outside air. In cold weather the patient should have blankets both over and under him, be clothed in a cap and warm, loose underclothing, opened at the back so that they may be easily removed. Thick mittens on the hands are comforting if the patient desires to have his hands outside the bed-covers. The nurse should be warmly clad, with a soft thick sweater, her feet should be protected with proper shoes, and her legs and ankles with warm underclothing and leggings. If the patient's bed-clothing has to be changed, or if the body has to be exposed, then of course the windows in the room must be closed, and if practicable heat turned on in the room. It is proper to have one of two arrangements, either the patient should be treated on a porch connecting with a room into which the bed can be rolled when changes are necessary, or two adjoining rooms should be used, the one in which the patient remains with the windows wide open as directed, the other to be kept warm for changing the patient's clothing. The time which the patient will spend in the room which is protected will depend largely upon the patient himself. Time and again a patient who has been out on the porch or in an open room with the temperature far below freezing, when brought into the warmer room which has been closed for the purpose of changing the patient, will make the request to be put into the open room or on the porch as soon as possible. A case in point is now in St. Timothy's Hospital, recovering from a pneumonia and a subsequent resection of a rib for empyema. He was treated during his attack of pneumonia on an open porch. After the rib resection he was put in the ward, but begged so hard for fresh air that he was transferred to the surgical porch, where he is now resting comfortably.

If inquiry is made of the patients they will almost without exception declare themselves more comfortable in the open porch or room. While it has seemed that patients do better in open cold rooms than when the weather is warm, it is not so much the temperature as it is the fresh air which is beneficial.

If a patient is put into a cold room, or on a cold porch, and put

there without free circulation of air, he will suffer about as much as though he were in a closed warm room. Open the windows and at once the patient will be more comfortable, whether the air be warm or cold. This rule of keeping the air fresh and in full circulation holds whether it is clear and dry or whether it is rainy. Protect the room and bed from storm by means of screens, but allow free circulation of the air.

These opinions may seem too radical, especially in regard to the opinions expressed in regard to the cold and to drafts. It is based upon the observation of many cases in hospital and private practice. There can be no question as to the good results coming from the fresh air. Protect the patient, and neither cold, drafts nor dampness will harm him.

Food. The food necessary to a pneumonia patient should be nourishing, and of not too great quantity. It should be of a character which will not undergo fermentation in the intestines any more than is possible. The bowels should be regularly moved so as to prevent collection of fecal material and consequent intestinal distention. Food should be stopped or reduced to a minimum when abdominal distention becomes serious.

Constant Watchfulness. A good, trained nurse constantly in attendance is just as necessary in pneumonia as it is in typhoid fever. A sudden delirium, or rapidly occurring cardiac failure may not be observed if no one is in attendance who knows how to interpret symptoms.

The physician should either see the patient twice a day or should be in a position to hear from a well-trained nurse over the telephone during the day.

What is proper medication? The use of drugs we believe of positive value; the careful avoidance of any drugs or preparations which are of doubtful value. I would suggest drugs of positive value—digitalis, morphin, and atrophin, and will speak of them later together with others. I believe the pneumococcic serum of the shops and the vaccines should be avoided. Pneumonia has a high enough death rate without adding anything to the burden of the suffering patients.

Acute Dilatation of the Stomach. This condition is more frequently a complication of pneumonia than is supposed.

It occurs usually just after the crisis has occurred or after the patient seems to be on his way to recovery following lysis. The patient is usually obstinately constipated, is shocked, and vomits large amounts of ill-smelling material from the stomach. There is great distention of the abdomen, especially in the epigastrium. This fulness is due to the stomach itself being dilated with liquid and gas. The cases are frequently mistaken for obstruction of the intestines, but having once been seen and recognized, they are easily thereafter diagnosed.

The treatment is lavage. Even when there is some doubt as to the diagnosis the passage of a stomach tube is demanded. The tube is easily swallowed and apparently does not greatly disturb the patient, though he seems and may be critically ill. On the contrary, if the diagnosis is correct the relief is almost instantaneous, the pulse becomes better, the cyanosis and shock less, and in a short time the patient is on the high road to recovery. If the diagnosis is not confirmed by the use of the tube the patient is not in the least harmed by the lavage. On the contrary he is somewhat relieved. The dilated stomach needs a repeated lavage, frequently about every twelve hours, for two or three days. The frequency with which the lavage is repeated and the time over which it must be repeated depends upon the condition of the patient. If the symptoms are entirely relieved the vomiting does not return, the collapse and constipation are overcome, there is no reason for repetition of the washing of the stomach, but the operation must be continued as long as the symptoms continue.

After the lavage the patient must be placed either on his right side or on his face. This relieves the constriction of the intestine, which always occurs in those cases whatever the sequence of the dilatation of the stomach and constriction under the mesenteric notch. The relief given removes the true obstruction which occurs at this spot. In addition the administration of eserine hydrochlorate or sulphate in $\frac{1}{24}$-grain doses, given hypodermically, is of great benefit.

The fluid intake of the patient must be decidedly curtailed.

The only excuse for surgical interference would be an erroneous diagnosis in which the condition is mistaken for obstruction of the bowels.

Reinfection Early and Late. This occurs very frequently. One sees a case with one lobe affected running a normal course, the local signs and symptoms disappearing, when suddenly another lobe, perhaps in the other lung, will suddenly become involved and the case go through another typical attack. Such a case was seen very recently with Doctor Astley. The man had an infection with type I infection; he had been given 150 c.c. of serum under the direction of the Pneumonia Commission, the symptoms were slowly improving, and the temperature had reached almost normal. He suddenly developed acute dilatation of the stomach and distention of the abdomen. Examination of the chest at 11 A.M., February 25, which was made as carefully as the condition of the patient would permit, because of the appearance of increasing toxemia, failed to show any involvement of new areas. At 11 P.M. of the same day he was actively delirious, and there was complete consolidation of the apex of the other lung. He died in less than twenty-four hours from the time he was originally seen by me. A case in the wards of the Episcopal Hospital went through a complete attack of croupous pneumonia, including the crisis. Several days after he developed fever and complete consolidation of the other lower lobe, and made a complete recovery. The period of time between the two attacks, and the complete picture of the second attack in this case would justify the term relapse being applied to it.

Endocarditis and Pericarditis. Endocarditis and pericarditis occur frequently, sometimes in the beginning of the attack, when they form a more or less serious part of the symptomatology of the case. At other times they appear suddenly as the last feature. As an example of the former case a young lad seen with Drs. Radcliffe Cheston and Edward Martin may be quoted. He had been subjected to a rigid examination by all three of us about noon because there was a grave question whether the case was

one of pneumonia or appendicitis. At six o'clock the same evening Dr. Cheston discovered a pericardial friction of as loud a character as I have ever heard. This case finally died from the general infection, the heart lesion being a serious element throughout the entire case.

The second case occurred in St. Timothy's Hospital in February just past. A woman, aged forty-five years, went through a sharp pneumonia attack which was ending by lysis. On the morning before she died she was evidently in excellent condition; during the next night she suddenly developed cardiac arrhythmia and developed just as suddenly an extremely loud pericardial friction, and died in a few hours of cardiac decompensation. It is, of course, a well-known fact that a pericardial friction may develop suddenly; this character usually has no particular relation to the pneumonia.

Rises of Temperature after Crises or Lysis, or failure of the temperature to reach normal after the tenth day, are a matter of great concern to the attending physician. These rises of temperature mean any one of several things—empyema, either massive or between the lobes; delayed resolution, reinfections, tuberculosis, or a prolonged reaction to the serum if it has been given. The most important perhaps in frequency, as well as lending themselves to treatment, are the empyemas. The numbers of times these collections of pus are overlooked is still almost beyond belief. This failure to recognize the presence of pus after an empyema is largely due to the still too common thought on the part of practitioners that the patient is suffering from delayed resolution, tuberculosis, or simply from "weakness," and a failure on the part of the doctor to look at the patient with the chest stripped. Just this winter I was asked to see a case of "delayed resolution." One glance at the stripped chest showed a heart pushed far to the left, with the right chest much distended and a great fluctuating mass near the apex of the chest. An empyema necessitatis. This was in the practice of a bright, well-educated, very busy practitioner. For some reason he had forgotten his essentials. Other cases, as Doctor Robinson has so plainly shown us, are missed because we do not persistently carry out all of the

means at our disposal for making the diagnosis—physical examination, the use of the fluoroscope and stereoscopic plates, needling, and, when need be, thoracotomy. In the presence of this persistent fever, therefore, we must exclude empyema before we subject our patient to a more or less fruitless treatment for any of the other causes mentioned for its presence.

Relation of Tuberculosis to Lobar Pneumonia. I have not collected statistics of enough cases of patients with known tuberculous lesions who have been seized with lobar pneumonia to prove the impression such cases have made upon me.

Several cases, however, prove this fact: *Certain individuals with tuberculous lesions of the lungs may go through a typical attack of pneumonia, the course of the lobar pneumonia may not differ from that occurring in individuals whose lungs are normal, and the tuberculosis lesion may not be increased.*

Of course, there are cases of tuberculosis quiescent, perhaps, in which this lesion is made active by the added pneumococcic infection, or where there is a reinfection plus pneumococcic lesion. Perhaps the saddest mistake is to take an acute tuberculous for croupous pneumonia, but the first statement holds true frequently enough to hold out a hopeful prognosis so far as to the tuberculosis is concerned.

Delirium. This is one of the symptoms which gives much trouble. It is, of course, due to the toxemia present. If of a low, muttering type it is best treated by large amounts of water by the mouth, the rectum, and if need be by the skin, hypodermoclysis, or by intravenous injections. Of particular importance is the method of control of the cases of active delirium. In many hospitals it is the routine practice to strap the patients to the bed. The ordinary restraining straps are barbarous; the delirious patient, fretting against the straps, wears himself out. I am sure I have seen deaths directly due to this means of control. They should not be used. A restraining sheet may be placed over the patient's chest which will truly restrain him, but will not cause him to exhaust himself. Every patient who is actively delirious should have at least one nurse constantly by his bedside. If the

patient is an alcoholic he should be given full doses of whisky or brandy; often he will respond at once and become quiet. The use of hypodermic injections of morphin is *imperative* in *all cases of active delirium*. It should be used in doses full enough to quiet the patient and be small enough not to narcotize him. The rest given by such medication will often mean the difference between life and death.

Circulatory Disturbances. The circulation is affected apparently in pneumonia in several ways: First by the septicemic conditions, in which the patient is poisoned by the toxin circulating in the blood. In this condition the heart is rapid and feeble, the first sound is weak, and the blood-pressure is frequently low. In regard to the height of the blood-pressure and the prognosis of the case—a low pressure is significant of a severe toxic state, though occasioned just at the height of the sepsis and when death is imminent—there is rising blood-pressure.

The circulation is also affected when there is much lung involvement, when the pulmonary circulation is embarrassed, when there is much cyanosis. In these conditions there is frequently high blood-pressure.

In the cases with sudden circulatory failure, with much cyanosis, leaking skin, and running, feeble pulse, there is apparently failure of the vasomotor system, and the patient is apparently in a state of shock.

Each of these conditions of the circulation needs a different treatment.

The first with high and often irregular fever, possibly with a low leukocytic count, low, muttering delirium—fresh air if it has not already been used, cold sponges, normal salt solution, whether by hypodermoclysis or intravenous injection or proctoclysis is valuable. Caffein in the form of caffein sodium benzoate used hypodermically; strychnin also is valuable. Digitalis should be used, but its value is much more problematical.

In the second condition, dilatation of the right side of the heart with a high blood-pressure, cyanosis, with an accentuation of the second pulmonary sound, blood-letting is of the greatest amount of value. Here, too, the use of digitalis is valuable. Other cardiac

stimulants also can be called into use here, such as caffein and ammonia.

The third condition with sudden fall of blood-pressure, running pulse, and leaking skin is the most hopeless of all. Strychnin, caffein and the intravenous injection of adrenalin chloride may be tried. In my experience, however, this is of little value. The pressure will rapidly rise, but is of extremely short duration. Strophanthin, digitalis must be used hypodermically, with the hope of strengthening the heart muscle.

Oxygen may be used and will give some comfort to the patient, but there is no lasting value by its use.

The Use of Efficient Drugs. *Digitalis.* Digitalis, in the writer's experience, is the most useful single drug in all cases of pneumonia with an organic heart disease. It should be given from the beginning of the attack in moderate doses, 10 drops of a good tincture three times in the twenty-four hours. This dose can be increased if the heart shows signs of dilatation, 10 drops used by the mouth or hypodermically can be given every three hours, care being taken that the quantity given is not large enough to cause poisoning by this most useful drug. Remember that when one uses digitalis he uses it because the patient surely needs help. Therefore, see that the digitalis is obtained from a source which will insure a potent article. Good digitalis may be life-saving; a worthless drug may sacrifice a life that otherwise could be saved. In cases without original organic heart disease, digitalis must be used at once and in good doses.

Strychnin. Pharmacologists tell us that strychnin neither raises the blood-pressure nor stimulates the heart. Be that as it may, good doses, $\frac{1}{30}$ grain, every three or four hours, used hypodermically, is of great value. The patient rests better, his pulse is stronger, and he is distinctly improved by its use. Therefore in severe cases in which there is toxemia, when the circulation is poor, I believe full doses of strychnin are not only indicated but are useful.

Caffein. The alkaloid in 2- or 3-grain doses by the mouth, or caffein sodium benzoate hypodermically, is of value when the

patient is weak, either from grave toxemia, or from failure of the circulation.

Camphor. In the form of camphorated oil used hypodermically, 1 or 3 grains of camphor every one or two hours is useful. It is by no means a specific, but sometimes will help to life the patient over the incline.

Nitroglycerin. This is a much abused drug. It is not a heart stimulant. The pulse becomes fuller after its use, but this is because the peripheral vessels are dilated. It is of apparent use when the heart is laboring and fighting again. Then the peripheral vessels are enough dilated to allow the heart to become more efficient. Cyanosis with a laboring right heart are the indications for its use. It should be used in full doses for a short time.

Oxygen. This gives relief to the patient, with much cyanosis and laboring heart. The respirations are quieted, the heart labors less. It is a good adjunct to fresh air. Fresh air, however, will usually make its use unnecessary.

Calomel. If there is much abdominal distention this will do good by causing bowel movements and by apparently lessening the tendency to fermentation in the intestinal tract.

Eserin and Pituitrin. These drugs are of value when there is much abdominal distention. They appear to cause the expulsion of gas from the intestinal tract by stimulating the muscular coat. They of late have been recommended and largely used as methods of maintaining the blood-pressure.

In a word, from one's own experience of pneumonia it can be said that the clinical manifestations of pneumonia are so varied, its complications are so numerous, and often so serious, that one when he comes to diagnosis and the treatment of the condition must be alive to every possibility which may arise. Experience in numerous cases, knowledge of the various conditions, will all go for naught in any given case, however, if the physician does not remain eternally watchful.

FINALE. Alcohol as a routine drug I do not consider advisable. Small amounts, 2 ounces of whisky, three times a day, may be burned up. In alcoholics it is a useful drug.

DISCUSSION OF PAPERS BY DRS. RIESMAN, COLE AND FUSSELL

Dr. George W. Norris: In the study of our pneumonia cases in the Pennsylvania Hospital in 1913–1914 the types of infection were determined in 115 cases. Of these, 33 per cent. were of type I; 24 per cent. of type II; 5 per cent. of type III; 34 per cent. of type IV. The vast majority of cases were of types I and II. In 1914–1915, 45 per cent. were of type IV; 30 per cent. of type I; 13 per cent. of type II; 7 per cent. of type III. This year the types have been determined in 54 cases, and of these type I represents 25 per cent.; type II, 16 per cent.; type III, 0.7 per cent.; type IV, 50 per cent. In other words, this year and year before last the majority of cases were of type IV; last year, of types I and II.

The observations of Dr. Russell Richardson showed what I think Dr. Cole and others have pointed out, *i. e.*, that accidental pneumonias which occur in summer time, or as the result of exposure to cold, usually belong to type IV. Pneumonias which occur in the winter, and without any history of exposure whatever, generally belong to types I, II or III. An analysis of the symptoms showed that the cough and pain occurred equally in all types; chill occurred less frequently in types I, II and III than in type IV, whereas dyspnea was more marked in the former. Complications were twice as frequent in type IV as in other types. Type identification has been a great stimulus to us at the hospital. It has been observed that in the cases receiving serum this winter the reaction was not nearly so violent as last year; the temperature would rise less than a degree, and this would be followed by a greater or less drop in temperature. Last year we frequently saw a rise in temperature to 106° and 107° F. I should like to ask Dr. Cole whether he can give any explanation of this. In one case this year the injection of serum was followed by a marked leukocytosis, the count rising from 5000 to 20,000. I should like to ask Dr. Cole whether this is usual. We have seen one case in which the toxemia seemed to continue after the temperature began to fall.

Dr. S. Solis Cohen: I should like to ask Dr. Cole whether it is true that a fifth strain has been identified out of the miscellaneous group of type IV? I have heard some statements to that effect, but have not been able to find the exact references.

Dr. Cole has said that the serum treatment has not, so far, been successful in cases of types II and III. Of type III, I have nothing now to say. Of type II, I have seen a number of identified cases, especially during the past year, in which the result of the intensive quinin treatment—

supplemented appropriately, according to the definite plan, of which I have spoken so frequently that I need not go further into detail now—has been very satisfactory. The mortality in the small group identified has been much lower than the 35 per cent. which Dr. Cole tells me is the result at the Rockefeller Institute at present, under the serum treatment. I cannot give the exact figures from memory, but it is less than 20 per cent.

Dr. Fussell has pointed out—and we all realize—that even for type I cases the serum is not generally available at present; and until it becomes so available we must continue to try to do what we can with drugs.

Now, there is no real antagonism between drug treatment and serum treatment. If I am fighting a powerful enemy and have two hands to fight with, would it not be folly to tie one hand behind my back? One can use drugs and serum in association; and so far as I am able to determine from my own study of pneumonia for more than thirty years, and from what I have been able to read of the reports of clinicians and experimenters—both of those who believe in drug treatment and of those who do not—the association of serum and quinin is the method which offers the best prospect even when the serum shall be available. Until then I believe, with many of the elders, for example, Juergensen, Bartholow, Da Costa, Gibson, and with our contemporaries, Henry, Galbraith, and Aufrecht and Petzold, that there is no drug in the *Pharmacopœia* worth to be spoken of in the same breath with quinin. Digitalis, pituitrin, camphor, creosote compounds, iodin, the alkaline diuretics, chlorides, opium, atropin, strychnin—or some of these—are useful auxiliaries, and may often have special indications; but with the exception of pituitrin and chlorides we can generally get along without them when quinin is used.

By quinin I mean not the alkaloid alone but all of its compounds, and all the modifications, synthetic and otherwise, of the group of cuprea and cinchona derivatives. Nevertheless there is a choice of forms. It is true that ethylhydrocuprein is enormously more potent as a pneumococcus-killer than is any quinin salt; but it is also much more toxic. As to quinin salts I prefer quinin and urea hydrochloride, both upon empirical and experimental grounds. Our Fellow, Dr. F. P. Henry, prefers the chlorhydrosulphate. Others prefer the dihydrochloride. All are effective. Certain experiments that, with Dr. Kolmer, I have elsewhere reported, indicate that quinin dihydrobromide has a special value as a germicide against all types of pneumococci under certain conditions.

But the germicidal action of the cinchonics is their least merit. In treating the pneumonias of man we are not merely treating a pneumococcus septicemia. We have to deal with a complex toxemia. It is not alone some toxic constituent or product of the pneumococcus that is

active in the production of this toxemia, or most dangerous, if active at all—and that question is still open. Many toxic substances are present; some, the result of the pathological process in the lung; some, the result of other pathological processes; and some, perhaps, only indirectly owing to the morbid changes initiated by the pneumococcus. Bactericide alone will not "cure" a pneumonia patient, or, of itself alone, enable a pneumonia patient to recover; and this is true of every pneumococcicide yet available, ethylhydrocuprein included. The quinin, apparently does more than kill the germ. It seems to interfere, in some manner yet to be determined—perhaps with the production—certainly with the effects, of one or more of the most virulent of the toxic products that constitute the elements of real danger in the *toxic complex* we call "pneumonia." Hence, I have called it, provisionally, a chemical antitoxic. In what manner, exactly, it plays its antitoxic part, experimental studies only can show. That it does play the part, clinical studies have amply proved.

Dr. James M. Anders: Reference has been made by both Dr. Robinson and Dr. Fussell to the occurrence of empyema in pneumonia. It seems to me that we should bear in mind the fact that while this is a very important complication, serous or serofibrinous pleurisy is even more frequently associated with pneumonia than is empyema. As soon as a pleural effusion occurs in pneumonia we should make a bacteriological diagnosis, and upon the organism present in the exudate, depends largely the gravity of the particular case; fortunately more than 75 per cent. are due to the pneumococcus. A smaller percentage are occasioned by the presence of the streptococcus or the streptococcus mixed with the pneumococcus. In these the prognosis is much more serious.

An examination of the clinical records of 2050 cases made several years ago by Morgan and myself showed that in 128 cases pleurisy was associated. Empyema was present in only a little over 2 per cent. of the 2050 cases, the remainder, or 6.2 per cent., being of the serofibrinous variety. I feel convinced that this complication which is the commonest as well as the most important of this leading disease, is frequently overlooked during life. This is shown clearly when we compare the postmortem records with the clinical. Dr. Morgan and I examined 445 fatal cases in which the autopsy records were detailed. We found that the percentage rose to 19 per cent. instead of a little over 8, as in the case of the clinical records. Again, I took occasion recently to examine the larger figures of Musser and Norris with respect to this complication and I found that in cases in which the autopsy records were given, upward of 40 per cent. showed the presence of pleurisy. These facts show that this complication is frequently overlooked during life, and I think it is

for the reason hinted at by Dr. Fussell. I would, however, emphasize more positively than he did the value of needling the patient when effusion is suspected. It is not wise to change the position of the patient, *e. g.*, from the lying to the sitting posture to determine movable dulness, but it is always wise when there is absence of vocal tactile fremitus and a flat note to percussion to needle the chest. Many cases would be accurately diagnosed, which go unrecognized at present, if this simple procedure were more frequently resorted to. In pleuritis associated with pneumonia it is my custom to needle as soon as I suspect the presence of fluid. When the fluid is of serous or serofibrinous character and there are no marked symptoms of intrathoracic pressure I do not interfere surgically until after the crisis has occurred, and it often happens that the exudate now disappears spontaneously with extraordinary rapidity. I follow this rule because of the fact that in the past, in cases in which I did resort to aspiration during the fastigium, although the added shock was slight, immediately disastrous results often followed. Of course, after the crisis, if Nature does not come to the rescue, it is safe to resort to operation. The treatment of empyema either as a complication or sequel of pneumonia is purely surgical.

Dr. M. Howard Fussell: I should like to emphasize the danger of rib resection in the presence of a large amount of fluid, particularly in a child. I have seen two deaths under such circumstances in children within the last two years. Death, I felt, was due to shock, and might have been avoided had aspiration been done and the patients allowed to rest, thus permitting the organs to become accustomed to the normal position. Rib resection should have been done first or followed in twenty-four hours or less.

Dr. Robinson (closing): I am in accord with Dr. Fussell's opinion regarding the danger of rib resection operations in cases of empyema in young children. I recently performed this operation upon a child aged three years. Death followed on the second day. The autopsy findings were negative as to cause of death. Dr. C. H. Mayo has emphasized that danger in these cases may be due to rapid absorption of toxins *via* the rib ends.

Dr. Anders refers to the occurrence of serofibrinous pleuritis in conjunction with pneumonia. I agree that such serofibrinous accumulations should not necessarily be drained at their first discovery, namely, during the active course of the pneumonia. I am, furthermore, not entirely in accord with the opinion which others have expressed that every chest fluid containing bacteria should be drained at once.

The occurrence of serocardial exudate associated with pneumonia and

generally with a serofibrinous pleuritis, is, I believe, an indication of septicemia. I have been impressed recently with the continued septic condition of a patient thus afflicted even after the drainage of the right pleural cavity and of the pericardium and aspiration of the left pleura.

Dr. Cole (closing): I am very much interested to hear Dr. Robinson take the attitude somewhat unusual in the surgeon, that we should not be in a hurry in operating for empyema. My opinion has been that as soon as the diagnosis of empyema is made it is better to open the chest. Certainly, I have seen some bad results where delay has occurred, but do not remember any case in which operation has been performed too soon. I am also interested to note that Dr. Robinson has seen cases with organisms in the fluid recover without operation, not going on to pus formation. Of course, what we call "pus" is difficult to say, or how many leukocytes make pus. I personally have not seen cases in which bacteria were present in the fluid, in which the fluid did not become purulent when we left them alone. I know, however, that such cases do occur. Our rule has been to operate if bacteria were present in the fluid, even though the fluid were only moderately turbid.

In abscess in the lung, auscultation and percussion, it seems to me, are of great help in locating the proximity of the abscess to the surface. Early treatment is of very great value in the cases of abscess. When the abscess can be localized and is near the surface early drainage may lead to rapid and complete recovery. The effects of chronic abscess are so serious and the difficulties of operation so great that one hesitates to delay operative proceedings after the diagnosis is once made, though, of course, many attendant circumstances must be taken into consideration.

In the presence of serum sickness we must be careful not to ascribe all symptoms to the serum sickness and overlook other complications. Because serum sickness causes fever we should not forget to look most carefully for empyema in every case of continued fever after pneumonia. Very frequently when we are in doubt we have an *x*-ray taken every day and watch the case most carefully to detect a developing empyema as early as possible. I do not recall a case of pneumonia in which marked toxemia persisted, although the temperature had fallen to normal. Replying to Dr. Cohen, in regard to the subject of types, we have not been able to demonstrate any immunological relationship between members of the type IV group although Miss Olmstead at the Presbyterian Hospital, New York, has worked out such a relationship in some instances. In South Africa there has been found a type of pneumococcus which has not yet been seen here. We are not yet convinced of the value of ethylhydrocuprein in the treatment of pneumonia, though our investigations of this drug are being continued.

THE THREAT OF NATIONAL INEFFICIENCY FROM ILL-HEALTH

By A. T. McCORMACK, M.D.
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Every lawgiver since Moses, every physician since Hippocrates, all have joined in statute and injunction that a sound mind in a sound body is essential to productive citizenship. Yet Babylonian, Egyptian, Greek, Roman, Saracenic, the historic civilizations, have been born and flourished, and have been destroyed because they failed to properly correlate health and efficiency. Regardless of your knowledge and mine, that almost half of the annual death rate of the United States is premature, caused by diseases which can and should be entirely prevented; in spite of the progress that has been made in your State and mine in abstract knowledge of the sanitary laws of life, and in no other State has greater progress been made than in Pennsylvania, under the able leadership of Dr. Dixon and his colaborers, our country is confronted with a demonstrable threat of national inefficiency from ill health. It is my purpose not merely to arouse this distinguished body to a realization of this threat. A mere rhetorical display which would present to you the history of the mistakes of past ages would be as futile as it has always been. I would awaken you not only to the dangers which threaten, but to your own duty and responsibility in devising practicable measures for preventing them while there is yet time. It is to such organizations as this that the country has a right to look for leadership—such inspired leadership as will not only present its facts convincingly, as will fearlessly denounce error or mistake in men or methods; as will, above all, devise and demonstrate the correct ways and means; and then will persuade county

[1] The Mary Scott Newbold Lecture, read March 29, 1917.

commissioners, city boards, State legislatures and the National Congress to adopt such ways and means as will carry the lessons which mean health, life and efficiency to every individual in every home, however remote in the country, however crowded in the city.

It is with this purpose that I shall present to you certain fundamental facts as a basis for the executive and educational structure I would rear, embracing not health alone, but all those elements of action and knowledge on the part of its citizenship which are essential to the welfare of the Republic.

Naturally these statements of fact will be based largely upon my own experience as executive officer of the State Board of Health of Kentucky, and will suggest remedies for the conditions which exist there, because these conditions can be multiplied by the number of States in the Union, except that the factors going to make up the sum total of good or bad health of the people of each State vary with many more or less local conditions, which it is not necessary for me to enumerate here. In Kentucky we have about 30,000 deaths each year and a few more than 60,000 births. Of the deaths not only are practically 14,000 each year from diseases which we now know how to prevent, but the enormous sick rate of which these 14,000 deaths are the ultimate and tangible result would likewise have been entirely prevented had modern sanitary knowledge been applied by the people themselves at the right time. For example, in 1916, a typical year, we had 4291 deaths from tuberculosis, and 25,746 cases of illness from this disease were reported; 1249 little babies died with the diarrheal disorders of infancy and 24,980 of them were reported as ill from this disease; there were 710 deaths from typhoid fever and 10,650 people suffered from this purely filth-borne disease; 401 Kentuckians died from diphtheria, while 4014 of them had their lives endangered from this cause; there were 136 deaths from measles from 6800 cases, and 241 from whooping-cough from 15,050 cases; 1120 of our citizens died from cancer, and there were 1584 killed by industrial or other violence. In other words, and summing the matter up in a common denominator, which is understood wherever English is spoken, during 1916,

which has been an average year so far as sickness and death have been concerned, preventable illness has cost the people of Kentucky in unnecessary doctors', druggists' and nurses' bills and loss of time from work, $12,135,586. During the same time, in its dead citizens, valued by economists purely as machines at $1700 each, that Commonwealth has lost $21,998,000 in the unnecessary premature and preventable deaths that have occurred. As badly as the State needs many things, it is wasting the enormous equivalent in human flesh and blood of $34,000,000 a year in wholly unnecessary sickness and death, at least three-fourths of which is readily preventable and should and can be prevented within ten years.

Last summer, when our militia was mobilized, as a member of the Medical Reserve Corps of the United States Army I was ordered to assist in the examination of the Kentucky militia. At the call of the President and country there assembled 4200 militiamen who were selected, as prescribed by law, from among the thousands of their countrymen who would gladly have responded to the Union's call. These men were selected by their officers, because superficially, at least, they seemed to possess the physical stamina and mental caliber necessary to make soldiers. When the physical examinations were completed, and they were conducted entirely by experienced Kentucky physicians, it was found that 1600, or 37 per cent., were physically unfit to go to the Front. I regret to say that I believe this average would apply the country over. Unfortunately, the exact statistics as to the causes for these rejections have not been given out by the War Department, but as I participated in the examination of each of them I can safely say that of these 1600 men at least one-half, or nearly 20 per cent. of the total, were as useless and worthless as citizens as they would have been soldiers. They represented a cigarette-smoking, whisky-drinking degenerate, because diseased, riffraff from our cities and small towns, with neither morals, mind nor physique sufficient to enable them to solve any of the complex problems of modern life in such a way as to make them useful. I regret to say that I believe had this mobilization been of our women, although

the causes of deficiency would have been superficially different, practically the same results would have presented themselves. Necessarily and naturally these figures do not include the obviously unfit, such as the insane, feeble-minded, criminal classes, but I desire to call attention to the existence of an inefficient class in the United States, largely due to physical causes entirely preventable or remediable, constituting approximately one-fifth of our population, who remain so constantly inefficient throughout life that they are not self-maintaining, but are community or family burdens, and are therefore public charges directly or indirectly.

As a natural corollary of these vital facts, and as an equally damning factor in the education of our youth for citizenship, I ask your attention for a moment to these facts gleaned from the census reports:

Between 1870 and 1900 the population of the United States increased from 38,000,000 to 76,000,000 and in the same period the tilled farm land area increased from 400,000,000 acres to 839,000,000 acres. On the other hand, from 1900 to 1910 there was a 21 per cent. increase in the population of our country and a 4.8 per cent. increase in the land in farms. There has been no increase in the production of food grains in the last twenty years. Between 1900 and 1910 there was an actual decrease of 20,000,000 of the food-producing animals, although there was an increase of 16,000,000 people in the same time. Between 1880 and 1910 the area of tilled farm lands in New England, New York and New Jersey decreased 9,809,834 acres, and in a recent address before its Legislature the Governor of Virginia announced that there are now in that State 10,000,000 acres of tillable unfarmed lands.

Turning from results to causes, let us consider the basis upon which we now term diseases as preventable, realizing that preventive medicine is in its infancy, and that such a consideration is elementary and suggestive as compared with what may actually be done when the health part of education has received its proper emphasis.

Preventable diseases are grown from seed, which we call germs, just as crops or weeds are grown. Just as the seed of wheat and

barley grow best in the North, and cotton and sugar-cane in the South, so the germs of tuberculosis, of diphtheria, of pneumonia have their natural locus in the respiratory tract, while those of typhoid fever, the dysenteries and the intestinal parasites are found developing in the intestines. As the seeds and their products, as food, from Northern fields are distributed not only through the South but throughout the nations of the earth—to those in direct line first; just so these disease seed and their products, as poisons, are found scattered through the whole body of the one in whom they develop and are thence conveyed to relatives, neighbors, friends—to those in direct line first. The natural laws under which the seed of the field are planted, develop their crops and are harvested are no *more definitely* known than are those in accordance with which the seed of these diseases are propagated, develop their symptoms and are harvested as unnecessary sickness, preventable death or lingering inefficiency. While it is true that scientists understand the one as definitely as the other the practical knowledge of crop management is in the hands of those who manage crops; the practical knowledge of disease prevention and human efficiency is not in the hands of those who would live and who would be efficient. It is the man who has the disease who must know how to prevent the spread of the disease seed which have developed in his body. Sanitation has too much emphasized the wrong of having disease as distinguished from the crime of spreading disease. It would be neither difficult nor expensive for every individual to so manage himself that practically all the excretions which might harbor diseased seed would be so disposed of that they would not reach some other individual. A child who contracts diphtheria or influenza from you or me and dies is poisoned, is murdered as much as if you or I poisoned it with strychnin or arsenic. When this fundamental fact is known to every individual, health departments will only investigate causes and effects with a view of enlarging their functions to include many other diseases and conditions which are now contributing to inefficiency, but which we are as yet unable to prevent, and will assist those who have an aroused health conscience not to spread

disease when sick; will, by frequent physical examinations and reëxaminations, help each and all to practical knowledge of how to live and work and play; will bring before the courts those criminals who propagate disease; and, more than all else, will continue to take their part in the training of the young during their formative periods in all these things.

How may these desirable ends be brought about in these physically degenerate days in which we live?

I shall answer this query by telling you of a definite campaign conducted by the State Board of Health of Kentucky, financed by the Rockefeller Commission for the eradication of hookworm disease. The incidents of this campaign, with its successes and failures, constitute the most brilliant page of health work in Kentucky, and the lessons it has taught there are capable of universal application in all sections and for all diseases.

In order to make this clear, I must tell you what we told the people at every cross-roads in the counties where these public health campaigns were conducted about hookworm disease. This disease is most prevalent in the sandy soils of our hill and mountain sections. The people of this part of Kentucky are a pure-bred Anglo-Saxon people. They have the virtues and faults of their ancestry. Hospitable, frugal, conservative, it is necessary to actually show them the proof of one's proposition; but once convinced, it is easy to get their coöperation, but difficult to keep it. About hookworm disease they knew nothing; hence did not believe such a disease existed. They did not actively believe it non-existent, as so-called more highly educated antis would, but had never heard of it. Even if there were such a thing, they did not believe they had it, or, if they did, that we could recognize or cure it, and many of them, religious but fatalistic, believe that, in common with all afflictions, if there is, and if they have hookworm disease, it has been given them for a good purpose by a higher power who will relieve them of it when He chooses. They gathered at our announced dispensaries by the dozens or hundreds, frequently coming for miles, quietly distrustful, but equally without prejudice for or against us or our propaganda.

The hookworm is about half as long as a common pin and about the size of a pin. In its natural size, seen singly, it does not appear formidable. But when you see its magnified mouth, with its hooks from which its name is derived, and know that once hooked into the intestine it sucks blood, each worm using a drop or more each day, and then, through what we may call its hollow fangs, it pours its poison into the blood stream, and that it is rarely found singly but usually by hundreds and not infrequently by thousands, it is easy to realize its twofold results in the individual, especially if young and undernourished, who harbors it. These are stunting of growth, frequently even to dwarfism, from the anemia or blood starvation, and toxemia from the poison injected. A boy of twenty may look as if he were ten or twelve—permanently ruined, dwarfed, hopeless, a mental, moral, physical wreck, stranded by an eddy in the river of progress—and yet live for years; while another, similarly infected, may develop the rapid anemia and toxemia, abdominal dropsy and general edema and death.

Each female worm lays eggs by the hundreds. These pass with the dejecta, and dropped where there is shade, moisture and warmth, the eggs soon hatch out their baby worms, and these are in a few days ready to push through the exposed skin of the toes, legs or hands of the next unthinking boy or girl who comes along. In the toes or along the legs they produce the symptom long known as dew poison, or toe itch, for which our grandmothers tied a greased, red flannel string around the big toe. This treatment always cured (?), because the tiny worms, $\frac{1}{400}$ of an inch long, rapidly work through the skin and flesh and swim along the veins to the heart and lungs, whence they are coughed up and then swallowed, finally attaching themselves in the intestines, sucking in their fold of its wall, and there they remain months or years until accident or treatment dislodges them, causing the various and vague symptoms and physical phenomena which go to make up what we call hookworm disease.

You understand that I am but sketching the picture which is drawn in the vernacular when talking to the people, a lantern slide showing each step to the eye as the words describe it to the ear. The audience listens, respectful, intent, but unconvinced.

We show them on the screens groups from neighboring sections—the nearer the better—calling attention to the expression, or rather lack of mobile expression, the laughless face, frequently asymmetrical; the staring fish eyes, the protuberant, dropsical abdomen—what they call pot-belly—in the children, the swollen legs, whole families consisting of many stunted, mirthless children, varying but little in size, but all prematurely aged and apparently with the weight of the ages on their too small shoulders. We throw on the screen the old houses, carved out of the forests by the hands of their pioneer forefathers, and get them to see with us their rotting timbers, broken porches, the irregular and broken comb-lines of the roof, missing rocks in unpointed, decaying chimneys. We picture the gradually decreasing acreage of tilled lands on the farms of which these houses are the homesteads, the successive areas of "new ground," cleared of their virginal forests, the surface soil frequently washed away, leaving the bare, gravely ditches washing over patches of dwarfed grain. Where the pioneers built homes the later generation built cabins, first log and now the miserable, rough, upright box houses that too frequent sawmills enable these decadents to build. Children, parents, homes, farms, orchards, even the infrequent livestock, all seem to be laboring under some spell that makes them slow and heavy, dull and listless. Not all of any section of Kentucky is like this gloomy picture, and in many parts of the State there is as little hookworm disease as in Pennsylvania. The exceptions in the affected sections are the rifts in the clouds that show what all could be, what all have a right to be, when they are cared for as human beings, examined and treated, and then followed up and rehabilitated, shown how to earn a living, and then how to live. Just as we lead them on the pathway to health, so must they as carefully, as slowly, as thoughtfully, be taught to see and tread the other paths; all essential for them to know the road to wholesome, moral, useful life.

Next, pictured on the screen, is shown a dilapidated building—evidently not a safe or fit refuge or abiding place for the beasts of the field—and we try to show the futility of such schoolhouses for any practical training in life *as it should be* distinguished from

as it is. A few interiors from the worst class of schools; many without desks, having only rough benches; others with desks designed by a descendant of old Procrustes, the feet of the smaller children dangling, asleep, on their tiny legs varying inches from the floor, the gaunt legs of the older ones twisted, scissors fashion, as they bend their stooped shoulders to try to cipher or decipher in the poorly lighted, badly ventilated room. Stove and children quickly consume between them the available oxygen, and the poor youngsters who continue to drink at these Pierian springs hibernate through their school days, asphyxiating themselves as the bears in the same wilds did before them.

Small wonder when one sees such schools, and even much better ones, and knows what these children and their parents "sense," without exactly knowing that they know, that the curriculum is as useless in their lives as "a painted ship on a painted ocean," that the investigation in one of our best counties has shown that 47 per cent. of those of school age are enrolled as pupils in the common schools in spite of drastic compulsory education laws. Of this less than half of the children, only 20 per cent. enter high school; while but 3 per cent. of the latter go to college, and, last and most significant, in this good county, of this 3 per cent., trained under a wholly impractical and inefficient system, less than 0.1 per cent. return to and live in the county which educated them. And yet, wonderful to relate, the whole course of education from the first grade to the eighth, through the high school and the college, is framed, as it came through Virginia from England, for the negligible minimum who are too frequently taught just enough to ruin them for useful lives in their natural rural environment and driven to make a large part of the half-baked, underpaid, submerged professional or semiprofessional town or city men. What a wealth of truth and philosophy, what a general application, had Uncle Remus's exclamation about his humbler race: "Put a spellin' book in a nigger's hand an' right den an' dar you ruins a plowhand! Wid one bar'l stave I can fa'rly lift the veil of ignorance; yes, honey, wid one bar'l stave I can teach more dan all the schools twixt dis and Michigan!"

And yet in one of the humblest of these schools was observed one of the most pathetic examples of primal vocational education. In the very heart of the hills we found it, its teacher and each and every one of its forty-five pupils, a victim of hookworm disease, to say nothing of other ailments, and as we went in we found this teacher giving a rather complex lesson in music to these pupils! On a blackboard, once black calico, and blacked and reblacked with stove polish or shoe blacking, he had laboriously drawn his bars and notes where his flimsy "board" rested against the smooth logs, leaving his students to read between the lines what they would where the rough "chinkin" made writing impossible. Standing in the door of this cabin school I could look across a ravine and see a ledge of coal that underlies practically all of this county, and yet wood in a tight stove consumed the scanty oxygen of these already anemic pupils. As I thought that if these children went through the eight years of the common school, and then, as no child has yet done from that district, spent four years in a high school and four in a college, and more yet in a university, he might and would be taught many things, he might learn to become a faddist or to call himself a philosopher; but in them all he would never learn things that he could bring back home to his own kind which would call them out from their inefficient, because diseased, lives and teach them the value of the soil and minerals with which they are surrounded. It was only after returning home, that, pondering over these things and others, I realized that the teacher taught wiser than he knew. In Kentucky, out of each five babies born one dies in infancy; another in childhood; a third between childhood and womanhood or manhood; and, of the other two, only one goes to school: and it dawned on me that this poor teacher, intuitively feeling these things he could not know, taught music because his pupils would, mostly, join the heavenly choir, where music will be their vocation!

These details are essential to the preparation of these peoples' minds, but they all have seen all these things throughout their lives, without realizing their cause, effect or relative proportion, and this recital leaves them unconvinced of the reality of hookworm disease.

But the screen tells human stories, written, it almost seems, in the very blood of those it pictures.

In the contrast between these two nineteen-year-old boys you will see the dwarfing effects of the disease these parasites cause. In the Bryant family, note the marked results of the disease itself not only in the anemia and edema but the squalor and abject poverty—the hopeless worthlessness of them all. Or see another family in another county, typical of hundreds of their too prolific kind, who never laughed, sang, bathed, thought or worked. Primitive almost as when Druids were priests, glance into their cooking and eating arrangements, and you who never knew the pangs of hunger unappeased, pause with me and contemplate the revolting mess of corn and beans swimming in unsavory fattish water and turn away in natural disgust and as naturally ask, "Am I my neighbor's keeper?" Then think of your own slums, of your own brothels, of your grog-shops, of your burdens, and reconcile yourselves with your own forgotten ineffectives and the great Father "who must love the poor because he made so many of them," think and pray a little for this stranded section, peopled by your own flesh and blood, and remember that most of these men and women are potential sons or daughters of the Revolution which won our freedom; that they are as proud and patriotic as they are shy, ignorant and impoverished; that that they have forgotten and been forgotten too long to be able or willing to redeem themselves; that thousands of them are paupered inefficients, resident in pauper counties, and that this nation can ill afford to lose them or their kind. They hold as much promise for the future as any section of the race. Make them conscious of their real condition, help to lead them into all that is best of Christian civilization, and at an expenditure of a few cents per capita for a few years, you can add a better, bigger Scotland to the world.

See H—— C——. This poor, miserable, dying wretch was hauled from the county poorhouse to one of our dispensaries for miles in a jolt sled. Pellagrous, edematous, gasping for breath, our inspector pulled him into this chair, and for two years I used his

picture to illustrate the end-result of a certain part of these poor people. One night I told his story to our Legislature, and one of the Senators, recognizing him, exclaimed: "Why, Doctor, that man is alive and well! You almost refused to give him any medicine because he was so near dead. But he took it after that long ride back and they said he passed thousands of little worms. He is not dead at all but is now a mine foreman, making over $5 a day." And this time he appears as an honest workman, his clothes, once empty, almost too full of healthy manhood, and, when again you see him, dressed up on his way to a ball game, you can see he is learning, late in life, the elements of play, which are as essential as work to well-rounded development, and which is a rarer accomplishment even than work in this workaday world of ours.

> "And the other sex, the tender, the fair;
> What wide reverses of fortune are there!"

See this hopeless, bedecked and bediked little shadow of humanity transformed as by magic, at a cost of 25 cents, into this palpitating, breathing, living girl, budding into all the wonderful opportunities of American womanhood.

Let me introduce to you to H—— L——. As I first saw him when he strayed, more in the semblance of a fox or rabbit, into a crowded dispensary group, the good country doctor, who was the mainstay and inspiration of that particular clinic, as some good country doctor was of all of them, came over to me and whispered: "Get that fellow out as soon as you can. His kind are so degenerate, he is such a pariah that soon no one else will be here if we keep him." Naturally interested in "poor white trash," these hopeless human derelicts, the diseased and ignorant driftwood of our own race, I led him, as one might a stray pup, to the barn, and when we had undressed him we thought we had a case of *tinea versicoloris* or some rarer skin disease, but subsequent developments showed it to be ingrained dirt. H—— had never worn his clothes out; he had worn them in. He had, when opportunity offered, added any outer garment which might cover a hole or reinforce a thin place, and soap and water repeatedly applied for

months uncovered the skin underneath, as a little medicine and much kindness and some food brought the mind and soul that had sulked in that miserable body. At this interview H—— was too wild and shy, as well as ignorant, to tell his story, but it was drawn from him by piecemeal as he developed. He was about twenty-four years old. He did not remember having seen either his father or mother, but of the latter "had heerd she was an ole woman over the hill." I asked him if he ever earned any money. He replied, "$6." Remembering that he was twenty-four years old, I asked him how he earned it. "I sold my vote three times for $2 each time." "For whom did you vote?" "I do not know. The man who traded with me told me to take a stick I would find on the shelf back of the curtain and make a mark with the pointed end of it in a ring under a house on the paper, and then come out and tell him the kind of a house it was and he would give me $2." I never think of the pathos of this poor fellow's degradation without wondering how a man who opposed his wife's right to vote could reconcile her to any confidence in his judgment and sense of fairness if he believed in manhood suffrage, and that this animal should vote merely because he had a semblance of a man.

In one of our interviews I asked H—— if he had ever heard of the Bible. "No, I never heerd of no such thing!" "H——, did you ever hear of Jesus Christ?" "No," came his slow reply; "there was never nobody by such a name in these parts." And in his part there never had been! From the miserable hovel on the hillside where he lived, or rather existed, the spires of three churches could be seen pointing toward the blue sky. Inquiry showed that each of them made substantial contributions toward the support of missionaries in Asia and in Africa. In this they are right, but I'd rather have H—— L——'s chance for admission to the eternal home than to have that of all those who merely contribute of their surplus to pay substitutes to do their work in His vineyard here! H——'s treatment cost less than a dollar. He is an Anglo-Saxon white man, of our own flesh and blood. He earns almost as much per day for honest labor as he had been paid in twenty-four years for his dishonor! He has occupied his idle

hours wandering over bridle paths through his native hills securing specimens for examination and taking back the medicine to those found infested, so that they may have the benefits he has secured. Is not work worth while which will redeem such pariahs? There are many of them within a few blocks of where I speak, wherever that may be, in any part of this Christian land we profess to love. And I would rather have H——'s chance here and hereafter than yours or mine, unless we are willing to give some of ourselves, our brawn and brain to the service of our neighbors.

I wish all of you could have seen these two poor children when I first saw them. They were born almost in sight of the birthplace of and from the same social substratum as our great President, Abraham Lincoln. A telephone message came to us from the neighborhood physician that he had five cases in one family which seemed a combination of Bright's disease and peritoneal tuberculosis which he wanted investigated. Two of the little lives had snuffed out before we saw them. Hookworms were so thick in their starved little intestines that they seemed like wet hair-brushes, These little fellows, white as alabaster, emaciated yet edematous, looked like the spectres they soon would have been. But 20 cents worth of medicine transformed and a little kindness redeemed them and their parents too. See them first after a year and mark the mere physical transformation. This in itself would not have been so remarkable, because we have often seen the emaciated and the weak restored to health and strength by love and care. But this is actual redemption. A little search would have revealed these lads' grandparents who were neighbors and friends, no doubt, of Tom Lincoln and Nancy Hanks. You can note the miserable hovel in which they were found; sitting in the mud of the "dog-trot." Take a nearer view with me of these two old wrecks who had tottered through their worthless existence, without conscious knowledge of any of the higher impulses which distinguish the human from the brute. Will you turn with me again to the grandchildren, after two years, and as we see them, the first of their breed that ever worked; descended, as they were, from the poorest of "poor white trash," and realize that in five short years these

three boys and their once shiftless father and mother and sister and little brothers have become real people, that he has paid off the mortgage on their rough farm, that they burned some lime and planted legumes on their wornout fields; that their new home has screened windows in its dining-room-kitchin and that a Kentucky sanitary privy, devised by my father as a necessity of this campaign, self-cleaning, fly-proof, water-tight and clean, which prevents the possibility of the soil pollution which has dragged their family in its degraded depths, and, at the same time, fertilizes a flower bed, typical of the bloom of hope, of life, now and in eternity, that has come to them: will you not with me return thanks to the Great Physician that these in their redemption showed how the inefficient, submerged element of our race may be redeemed.

Our audiences listen to these recitals, moved emotionally, as you are, by them; but they listen as to the average sermon—with approval, even appreciation of what has been done for these poor sufferers, but without any idea or thought that they themselves are sufferers. They are willing, though, almost every single one of them, to take a great step forward in coöperation with us—as they file out of the meeting place they take the proffered little tin pill-boxes, and next morning each of them brings it, half-filled with feces, for examination for the eggs of the various parasites. The bright young women, trained in our laboratories as microscopists, who travel with us to these people, soon find, in some specimen, hookworm eggs, and it is surprising how the countryman, used to sighting a rifle, can be taught to sight down the inside of the barrel of a microscope. Always, in some one specimen at least, there will be discovered live embryonic worms just emerging from their shells, wriggling about the microscopic field. Leaders of public opinion at once become zealous converts. The wealth of conviction with which one of these old weather-beaten dubitists, straightening his full length after inspecting these tiny varmints that have come from his own person, exclaims: "Wall! I'll be durned! I never knowed I were a durned snake-hole," indicates a revolution in the inner man, and the unbeliever is transformed into a willing follower. And, like his fellow Anglo-Saxons every-

where, when he has taken the medicine which was freely given him and finds subsequently that he has been harboring countless, tiny leeches, that had been sucking his blood and his vitality, he is seized with the missionary spirit, and goes forth to bring his neighbors and relatives that they too may find relief. Almost 100,000 were treated during this great campaign. Thousands of these were permanently cured. Hundreds were redeemed from utter worthlessness and hopelessness here and hereafter.

Unfortunately for Kentucky, the life of the Rockefeller Commission for the Eradication of Hookworm Disease expired and its successors are working in community units which do not exist, and which we would not bring into existence if we could, or have been able to find fields of endeavor in other States, more fortunate in their fiscal systems or under alien flags who can and will coöperate with them so much more fully than we can, that our work has been slowed down to what can be done by ourselves alone. As always, that part of Kentucky which needs the most is the most helpless, and under an archaic revenue system that places its heaviest burden on the land without producing enough income to maintain the State, the outlook for the present is gloomy indeed.

The small triangle in the north central part of the State, with Maysville, Stanford, and Louisville at its corners, is our productive section. Outside of it are but six counties which support themselves. Without help the people of that section of the State most affected by this one disease must, because their section is underlaid with rich minerals, become laborers in the mines over which their fathers held dominion, or, like other aborigines, give place to others less worthy of respect and regard, but more subservient and adaptable to the commercial civilization in which we live.

But they have taught us one lesson, which I would have you know, that health is but one, even if the most important one, of the requisites of efficiency. Recall for a moment the M——'s, and remember that for a year after they were cured of disease they were but husky brutes. It was only after they were shown how to work that they became efficient, and, subsequently, productive citizens. What we must have in rural Kentucky, as you in rural Penn-

sylvania, is an educational system which will put in their proper proportions and place a proper value upon not culture alone, as at present, but culture and agriculture, health and roads, the civil government of the world and the Divine government of mankind—will develop all these things into the warp and woof of every childish nature so that each of them will know how to do his job well; will know how to enjoy and help control, and defend, if need be, our freedom and our country; will be taught enough of the sciences and the arts to appreciate his own work and to realize the necessity of that of his fellow-men; will be trained to live so that he will avoid disabling disease and accident himself, but so that should either mishap overtake him, he will, at all hazards, prevent others from contracting it from him. He will do those things because they are right and because it is his duty to his country, to his God and to himself for him to be efficient!

I cannot consume enough of your time to more than glimpse the application of this plan to occupational diseases and to industrial injuries, and all that large class of diseases which produce not death alone, but lingering inefficiency, of which malaria, tuberculosis and cancer types.

How shall we be organized for such a nation-wide campaign? How may we substitute the State in the place of parents when the latter are but the empty semblance of the real thing? How shall we strike a balance between what demagogues howl about as liberty and that necessary patriotic restraint which is essential if we would rid ourselves of our ineffectives? How are we to avoid socialism and preserve individual liberty of action, and yet avoid national inefficiency?

I would answer these queries by saying we must have organization, education, law enforcement and executive control.

To secure national efficiency we must coördinate education with public health and all those other civic activities that go to the making of citizens out of men and women. We must have a Department of Public Health in Washington, of which our excellent Public Health Service should be the nucleus and the strong executive right arm. It must have attached to it the various

existing bureaus having health functions, now scattered aimlessly and at haphazard, unguided and uncontrolled, through various departments. It must have laboratories, modelled upon the splendid work now being done by the Hygienic Laboratory, but greatly enlarged, so that the basic problems, such as local health work, rural sanitation, home ventilation and hundreds of others almost entirely neglected, may find solution through scientific research. No stone may be left unturned until the exact cause, and then the practical methods of prevention and relief have been actually put into the hands of the people themselves through local educational and health agencies. State health departments, like headquarters of army corps, would put into execution those of the plans of the federal board of strategy, the National Department of Health, which would be necessary for their differing peoples. State laboratories would locate disease and would provide and distribute remedial and preventive sera and other necessary munitions which could be made universally available when needed, regardless of the economic condition of the individual or section where needed. State statistical bureaus would gather the facts in regard to the causes of sickness and death and inefficiency, and the federal head would so compile them that all the people would know where trouble was, so that concentrated effort on the part of all necessary agencies—federal, State, local and volunteer, could be focalized until it be relieved.

In a democracy, after all, the most important governmental agencies should be those local ones which come in closest contact with the daily lives of the people themselves. It is important to remember, however, that, while most important, they are frequently the least efficient. In the people they have many masters, most of whom are too busy with self-interest to give adequate supervision to their public employees. Local health departments must be so organized that they are autonomous, not dependent on local political conditions, empowered fully to take whatever action, wherever necessary, to prevent inefficiency through ill health. They must have a qualified and responsible head who should have been an experienced practising physician, with his

necessary technical knowledge of disease and the diseased, specially trained in the methods of preventive medicine. This all-time health officer and his necessary assistants should have a tenure of office dependent solely on honest and economic administration and diminishing the sick and death rate and their subsequent inefficiency. These assistants should be sufficiently numerous and similarly trained and qualified, under civil service, so they could carry to every individual in every home on every highway, in every byway, the necessary knowledge which means abundant life; so they could compel the negligent or unthoughtful or the criminal to do these things, with the distinct purpose of such an organization as will make the second case of preventable illness impossible and the first case improbable. Then, and not until then, will the people of the United States—thoroughly efficient, physically, morally and mentally capable of useful labor—realize on their constitutional contract with their Government, guaranteeing them not only in liberty, but in life and the pursuit of happiness.

"We raise no monument of graven stones
To mark the spot where some great battle raged;
Where nation spoke to nation in the tones
Of iron hate by crimson flood assuaged.

"No pillared hall of justice build we here,
Nor marble fane, nor house of narrow faith;
But firm and strong these fortress walls we rear,
To buttress out the ghastly hordes of death.

"The death that rides triumphant on the breeze,
That taints the crystal goblet ere we drink;
That brings the strong man trembling to his knees,
And hurls its gasping victim o'er the brink.

"We build a knightly hold along whose halls
The white-clad hosts of healing come and go;
And from the crest of battlemented walls,
Where struggling science marks her ancient foe.

"We give our red cross banner to the breeze,
Where all the stricken myriads can see;
And in the face of many-fanged disease
We hurl the gauntlet of the strong and free."

THE PROGNOSIS OF GALL-BLADDER INFECTIONS[1]

By JOHN H. GIBBON, M.D.

It is well in discussing any phase of surgery of the bile passages to have in mind that practically all lesions for which surgical interference is required have their origin in infections of the mucous membrane by microörganisms. The one condition for which we most frequently operate is gall-stones, and as Sir Berkeley Moynihan so tersely expresses it, "Every gall-stone is a monument erected to the evil memory of the germ which lies buried within it." Even malignant disease of the gall-bladder, if primary, in nearly all instances has its determining cause in irritation and ulceration caused by gall-stones which themselves are the result of infection. There can therefore be no question that a microbic infection is the starting-point of nearly all the diseases of the gall-bladder for which we operate, but the type of organism, except in the acute infections or the acute stage of the infections, plays little part in the prognosis.

The colon bacillus is by far the most frequent cause of the infection, and then the typhoid bacillus, the staphylococcus, and the streptococcus in the order named.

Acute cholecystitis, especially that due to the typhoid bacillus and occurring during or shortly after typhoid, is liable under proper treatment, to subside without operation, and only requires operation when there is not in a day or two a prompt subsidence of all the symptoms. The acute cholecystitis which is preceded by a history of gall-bladder symptoms extending over a considerable period of time will certainly require operation during or after the attack, and in these cases the prognosis is grave if the operation is delayed in the presence of marked and continuing symptoms of

[1] Read April 4, 1917.

sepsis, especially if jaundice is present. The gall-bladder, when acutely infected or in an acute exacerbation of a chronic infection behaves very much as does the appendix, and the prognosis is about the same in each, excepting, of course, a perforative peritonitis is not so likely in the gall-bladder cases; but gangrene, perforation by stones of the gall-bladder and intestinal walls, acute infection of the bile ducts and the pancreas and occasionally a general peritonitis may result. I am convinced that in the majority of instances the primary infection of the gall-bladder does not give rise to the symptoms of acute cholecystitis, but that the infection occurs insidiously and the supposedly acute infection is often as a matter of fact an acute exacerbation of an old infection, due to interference with the emptying of the gall-bladder by a stone. The cases of acute cholecystitis which are not apt to subside, and which rapidly pass on to gangrene and peritonitis, are those due to the staphylococcus and the streptococcus or to complete occlusion of the cystic duct by a stone. Some of the worst cases of acute cholecystitis I have operated upon have been those in which no stone was present, but an acute infection by one of these organisms. The symptoms of severe septic infection are very marked in these cases, and if the drainage of the gall-bladder is not done promptly, before the infection extends to the ducts and the liver, the prognosis is very grave. If jaundice is present it indicates a blocking of the hepatic or common duct by edema, and should add greatly to the gravity of the prognosis. If drainage is established early the prognosis is remarkably good, and if it is done late, even after gangrene has occurred, but before a general cholangitis has developed, it is not bad. It is astounding how patients recover after operations which reveal an extensive gangrenous condition of the gall-bladder and how grave the condition becomes when there is an obstruction to the flow of bile through the liver and ducts, as indicated by jaundice. I am now speaking of the acute infections without stones. When the obstruction to the flow of bile is due to the lodgment of a stone or stones which can be removed through an incision in the common duct and free drainage established the outlook is quite favorable, even in very sick patients.

As a basis for this paper I have studied my last 200 operations on the gall-bladder and ducts and have divided them into two series of 100 each. At first I thought 100 cases would be enough from which to draw conclusions, but later determined to go back over another 100 for verification and comparison of my conclusions. No case has been omitted because the lesion was not in the gall-bladder or ducts, and therefore in the list are a number of cases of cancer of the head of the pancreas and two of cancer of the stomach complicated by gall-stones. The inclusion of these cases greatly increased the operative mortality. We have also included in the mortality list a number of cases in which death did not occur for three or four months, and was due only indirectly to the operation.

So far as the cases of acute cholecystitis, in which operation was done during the height of the attack, are concerned there is no difference in the two series. In the 200 cases there were 8 cases without stone and 2 deaths, each due to septicemia, and 35 cases with stone and 10 deaths. The causes of death in these varied greatly: One was from acute hemorrhagic pancreatitis, present at the time of operation; 1 from hemorrhage from the gall-bladder and ducts two weeks after operation; 1 from suppurating pancreatitis four months after operation; 1 from pulmonary embolism three months after operation and following a thrombophlebitis of the saphenous vein; 1 from abscess of the liver and of the spleen present at the time of operation; 2 from septicemia; 1 from cirrhosis of the liver; 1 from cholangitis; 1 from acute endocarditis. These deaths comprise nearly one-half of the total number in both series of cases, and in most instances might have been prognosticated at the conclusion of the operation.

It must be apparent that an acute cholecystitis which does not promptly subside under treatment or which is characterized by severe symptoms of general infection and especially by jaundice is a very serious condition and demands prompt operation, which should comprise free drainage of the biliary tract. The cases of common duct infection, especially those in which we find the duct filled with a muddy sand which must be scooped out with a spoon, I think are the most serious cases we see excepting those compli-

cated by an acute hemorrhagic pancreatitis. In looking over these fatal cases I have been impressed with the fact that the majority of them have been private cases and not ward cases, and that in nearly all of them there was ample warrant for operation long before the acute exacerbation of the infection occurred.

In the 200 cases cancer of the gall-bladder was found in 8 cases, and it was apparently primary in 7 of these. In but 1 case could a radical operation be done, and in this case a section of the liver was removed with the gall-bladder. The patient is alive and well today, more than four years after operation. In one of the fatal cases I was uncertain whether an obstruction of the duodenum was due to cancer or syphilis. Cancer of the pancreas was found in 4 cases; cancer of the ampulla in 1 case and cancer of the stomach (with gall-stones) in 2 cases. In these 14 malignant cases there were 11 deaths. It is apparent then that cancer of the gall-bladder or of the pancreas carries with it a high operative mortality. Another observation of practical value is that gall-stones were responsible for nearly all the cases of primary cancer of the gall-bladder. Having accounted for 23 deaths, 12 in the acute septic cases (most of them having a cholangitis), and 11 in cases complicated by malignancy, I find 5 deaths unassigned; 1 was due to pulmonary embolism in a case of cholecystectomy; 1 to subdiaphragmatic abscess following choledochostomy; 2 to pneumonia, and 1 to complete suppression of urine.

One naturally asks whether the type of operation influences the prognosis, and I can say definitely that simple drainage of the gall-bladder in the hands of most operators is somewhat safer than cholecystectomy or the operations involving the opening of the common duct or the duodenum; but when these operations are plainly indicated simple drainage of the gall-bladdder will not in most instances save the patient or relieve him of his symptoms. In my last 100 cases I have removed the gall-bladder fifty-three times and in the previous 100 cases it was removed but eleven times. In reviewing the two series I cannot discover any difference in the mortality. In the 200 cases the common duct was opened and stones removed nineteen times and the duodenum opened twice to

facilitate the removal of a stone from the ampulla. In nearly all the malignant cases no operation on the gall-bladder or ducts was done.

The prognosis as to the recurrence of gall-stones is an interesting one, and my own experience leads me to believe that a true recurrence is very rare. I have operated a second time upon four of my patients for stone. In one I found a stone in the common duct which I believe was overlooked at the first operation two years previous when I had removed a great many stones from the gall-bladder and seven from the common duct. In another operated upon seven years after the first operation because of an intermittent biliary fistula I found one small stone; at the first operation the patient was very ill from a suppurating cholecystitis and cholangitis, and I had removed about 200 stones from the gall-bladder. I am rather inclined to think in this case a tiny stone was probably overlooked in the cystic duct. The third case was that of a physician who developed a recurrence of his symptoms about three years after his first operation, when I had removed 70 stones from the gall-bladder. I thought that in this case that again I might have overlooked a stone, but when I reopened the gall-bladder I found 25 soft mulberry stones, undoubtedly of recent formation. In the fourth case at the first operation I could feel no stones in the gall-bladder which appeared normal, and I did not open it. I attributed the symptoms to a band of adhesion extending from the pylorus to the abdominal wall. Three and a half years later at the second operation I found a single gall-stone. In this case it is quite possible that the stone may have been present at the first operation. In the last 3 cases the gall-bladder was removed at the second operation. All of these cases are not included in the list of 200 under consideration, but they comprise my entire personal experience with secondary operation for stone. In but 1 case, therefore, have I seen an undoubted redevelopment, of gall-stones following a primary operation for stone. This experience, I think, answers very well a query which is constantly put by the patient.

A rather interesting fact which is shown by a study of these 200 cases is that the danger of hemorrhage during and after operation

on patients deeply jaundiced is practically eliminated by the prophylactic injections of horse serum. Although scores of these patients had been deeply jaundiced for varying periods of time and the coagulation time greatly reduced, there was but one death from hemorrhage, a continuous oozing from the mucous membrane. Coagulation tests are very necessary in jaundiced patients in order properly to estimate the risk of operation.

The opening and drainage of the common duct when indicated by the presence of a stone not only does not add to the risk of the operation, but if carefully carried out reduces it. The passage of inflexible probes into the ducts to ascertain if the obstruction has been entirely removed is dangerous; flushing the ducts with sterile water is a much safer method. It is much safer to open the duct than to crush the stone or forcibly push it up into the cystic duct or gall-bladder. When a stone is wedged in the ampulla it is often better to remove it through an incision in the duodenum than through the duct.

In conclusion, I would say that the mortality in gall-bladder infections depends very largely upon whether or not a cholangitis is present and that a persistent jaundice accompanied by general symptoms of sepsis is of grave import and calls for prompt drainage through the gall-bladder or common duct, or both; that a patient having undoubted symptoms of gall-bladder infection should not be allowed to postpone operation until an acute exacerbation of the infection occurs; that even far-advanced and neglected cases of infection of the gall-bladder alone give good results following operation; that jaundice due to stone in the common duct in the absence of symptoms of sepsis is not necessarily a grave symptom if prompt operation is done; that the high mortality following operations occurs in the cases of long-standing gall-bladder symptoms with acute exacerbation of the infection and in cases of malignancy of the gall-bladder and pancreas; that the use of horse serum has practically eliminated the danger of hemorrhage due to long-standing jaundice; that the recurrence of gall-stones after thorough operation is extremely rare; and finally, that more is to be learned from the study of our failures than our successes.

SOME OF THE MEDICAL ASPECTS OF DISEASE OF THE GALL-BLADDER[1]

By THOMAS McCRAE, M.D.

In a discussion of the medical aspects of gall-bladder disease it is well to review the general principles which apply to disturbances in this region. As in other organs these may be anatomical or physiological, but much more attention has been paid to the former than to the latter. The gall-bladder is a storage reservoir connected with ducts which convey the secretions from the liver to the intestines, by which the constant secretion of bile from the liver is changed to an intermittent discharge into the intestine. It is evident that many possibilities of disturbance exist in such an arrangement just as they do in the urinary bladder, with which there are many points of similarity. The kidneys may send down infected or altered urine to the bladder; there may be inflammatory disease of the bladder itself; there may be retention; foreign bodies may form; there may be infection from below; and there may be obstruction to the discharge of its contents. So in the gall-bladder the material which is conveyed to it may differ in composition from time to time; there may be stasis; there is the frequent passage of organisms from above downward and the possibility of their entrance from below; foreign bodies (gall-stones) may be present; infection may arise locally or as part of a general infection; or there may be mechanical interference with the passage of bile. In addition there is a wide field of influence in what may be termed functional disturbance. The whole digestive tract is bound together in its working and a very

[1] Read April 4, 1917.

nice adjustment is necessary if the function of each part is to be properly performed. Disturbance in one part may be represented by improper function elsewhere, and this latter may manifest the symptoms. It is this which adds so much both to the interest and difficulty of abdominal diagnosis. In all of this it is evident that we cannot separate the gall-bladder from the ducts nor from the general function of the liver, as they are so closely associated, nor from the working of the whole digestive tract.

Before an audience such as this there is no need of discussing well-known questions. Certain forms of gall-bladder disease give little room for discussion. They are readily recognized and the indications for treatment are usually clear. Acute cholecystitis is an example. It is otherwise with the more chronic conditions, and it is regarding these that discussion is most profitable. Which of the disturbances mentioned above gives the greatest difficulty in diagnosis may be variously answered. In all probability the disturbance of function which is so apt to give symptoms at a distance is the most confusing and causative of error. Disturbance of function elsewhere due to gall-bladder disease we are familiar with, as seen so often in the stomach; but it is a nice question how often the reverse occurs, that is, that gall-bladder function is disturbed by disease elsewhere.

It is well to discuss some of the problems which have a bearing on gall-bladder disease.

Cholesterol. The importance of the amount of cholesterol in the blood in regard to gall-stone formation is one of the questions awaiting solution. Does the finding of an excess amount in the blood have any value in the diagnosis of gall-stones? In the Jefferson clinic this has been under investigation, particularly by Drs. Rehfus and Lichtenthaler, and some mention of the findings may be of interest. In 20 cases of proved cholelithiasis, in 16 there was a high cholesterol content in the blood, while in 4 the amount was normal or subnormal. It is well to remember that the condition of hypercholesteremia is not necessarily permanent. It may be present for a time, as, for example, during the period of formation of a stone, and then disappear. In this connection the

cholesterol content in typhoid fever is of interest. During the febrile stage this is low, but is high during recovery and for a variable time afterward. How much influence may this have on gall-stone formation following typhoid fever? Much work will be required to answer this question.

During the same period there were 5 cases in which a clinical diagnosis of gall-stones was made and in which the cholesterol content was low. At operation no stone was found. In 6 cases with a high cholesterol content gall-stones were not found at operation. These were not all diagnosed clinically as cholelithiasis. There are various conditions in which an increased amount of cholesterol is found, nephritis being a striking example. It is not suggested that the cholesterol content of the blood is a positive indication for or against gall-stones, but the evidence suggests that it has some bearing. Certainly it deserves thorough investigation.

Infection. In all considerations of gall-bladder disturbances, first place must be given to this. Much of what is commonly ascribed to the action of gall-stones is in reality the result of infection. There are many aspects to this problem which can best be discussed under various heads.

(*a*) *The Source of Infection.* In certain classes of cases there is no difficulty in determining this, as, for example, in typhoid fever, when it is part of a general infection. In other cases the origin is more obscure. The question may properly be raised as to how often this is from a focus of infection elsewhere. In discussing this I am quite aware of the present tendency to ascribe perhaps too much importance to focal infection, and yet it is difficult in reality to do this. There would not be much objection to regarding a diseased appendix as sometimes responsible for gall-bladder infection. Why should there be any more difficulty in regarding a focus of infection about a tooth as an equally probable source? With the many other possible sources it may be difficult to decide with certainty regarding a particular one, and only careful observation over a period of years can decide as to the frequency of infection from such a focus. At present I am following with interest

several patients in whom for one reason or another operation is not advisable or has been refused. Distinct gall-bladder disease is present, and with this they had marked mouth infection which has been corrected. This is not intended to suggest that the removal of one is going to result in the disappearance of the other, as a matter of course, but it may do so in some cases. How often an infective process in the gall-bladder subsides and remains permanently without symptoms no one can say. That it is possible there does not seem any reason to deny, but it is not likely to occur if marked alteration in the mucous membranes has occurred. In many cases an area of infection may be so chronic that no improvement is possible without radical measures.

(*b*) *An Infected Gall-bladder Acting as a Focus of Infection.* There is another side to the problem. How often does an infected gall-bladder act as a focus of infection for other parts? Attention has been drawn by Babcock to the frequency with which myocarditis is apparently secondary to gall-bladder disease. We see a similar condition sometimes resulting from an infected prostate. The importance of this in both cases may lie in the decision regarding operation. The myocardial condition may be regarded as a contra-indication against interference either in the case of gall-bladder or prostate disease and yet this may be the only thing which will result in cardiac improvement. The decision for or against operation in such cases requires good clinical judgment.

During the past winter I have seen two patients in whom there was a marked fibrositis associated with distinct fibroid nodules, apparently secondary to gall-bladder infection. In one, following removal of an infected gall-bladder, the fibrositis is decreasing.

(*c*) *Cholangitis and Infection of the Gall-bladder.* Another question arises as to the association between cholangitis, particularly the chronic variety, and gall-bladder infection. There is a certain interest as to the interdependent effect of these infected areas. In cholangitis we have, as a rule, involvement both of the intra- and extrahepatic ducts. The general opinion is that drainage of the gall-bladder offers the best hope of remedying the condition. If benefit results how much is due to the correction of the

gall-bladder infection. In cases in which the expected benefit does not follow drainage of the gall-bladder, how often is this due to a persistent cholangitis? The importance of infection of the intrahepatic ducts must also be recognized in the consideration of the expected benefit from removal of the gall-bladder. May it be that the explanation for some of the cases in which operation does not relieve lies in this? In removing the gall-bladder we may reduce a certain area of infection, but we do not necessarily rid the individual of it completely.

In the study of these cases we may hope for aid through cultures from the duodenum. This offers a wide field for the investigation of infections of the biliary passages. The organism most frequently obtained is the colon bacillus, but it is surprising how often B. pyocyaneus is found. In one patient, at present under observation, drainage and subsequently removal of the gall-bladder did not result in any improvement. Repeated cultures from the duodenum have always yielded B. pyocyaneus in pure culture. At present the effect of an autogenous vaccine is being tried.

(*d*) *Infection from the Intestine.* It seems probable that the fairly common colon bacillus infection of the gall-bladder is derived from the intestine. Of the factors governing this we know little, but it seems reasonable to suppose that stasis plays a part. The conception of Adami that what is so often called "intestinal intoxication" is really "intestinal infection" has much to recommend it. Here prevention has some part to play. We are aware how much influence the state of the bowels has on gall-bladder disease in many cases. May part of the explanation lie in this? How much of the condition termed "biliousness" is associated with infection from the intestine? May it be that there is in such attacks a specially heavy infection of the biliary passages with colon bacilli? The infection may be directly from the duodenum or more frequently through the blood stream.

(*e*) *Some of the Outside Results of Infection.* Among these the formation of adhesions plays a large part. The formation of adhesions to neighboring parts may confuse the picture and give much difficulty in diagnosis.

The question of infection is the important one in all discussion of gall-bladder conditions. In the causation of disturbances and in their continuance it plays the major part. From the medical side we are naturally especially interested in the problem of prevention. How much can we do in this? It must be confessed that very little is to be expected. The beginnings of infection are usually so gradual that danger signals are not displayed. If everyone took sensible food only and not too much of it, drank sufficient water, and kept the bowels freely open doubtless there would be less bile-duct infection. But who is rash enough to expect this? Previously the possible influence of foci of infection was noted. We cannot speak with certainty as to this, but the proper treatment of all such foci is undoubtedly good on general principles. Here again we have almost universal carelessness and ignorance to deal with. There is not in sight at present any great probability that the surgeons will starve for lack of gall-bladder operations.

The influence of gall-bladder disturbance on other parts of the digestive tract leads to more perplexity. Too often the upsetting of gastric function leads to incorrect diagnosis. How may this be avoided? Not by any royal road so far as is known to me. We have to investigate the gastric, pancreatic, and intestinal functions with care in order that exclusion may be carried to its termination. This demands long and careful investigation, and no catch words in the form of short cuts to diagnosis should be allowed, nor does it seem proper to advise exploration until we have exhausted all other means of investigation.

In this connection there are many possibilities in the study of the feces in gall-bladder conditions. Many patients show an insufficient digestion of fat, the usual change being that a proper splitting of fat has occurred but not proper absorption. There is also marked variation in the bile content of the feces from time to time.

How far a diet which is low in cholesterol can have an influence in prevention or cure is still in question. It would certainly seem wise to adopt it in cases in which there might be a special chance

of gall-stones forming, as, for example, in a patient with typhoid fever who had evidence of cholecystitis. If carried out in every convalescent from typhoid fever—which is evidently not possible —it might reduce the incidence of gall-stones.

In the diagnosis of the chronic and obscure disturbances of the digestive tract one of the dangers is of applying names such as indigestion, dyspepsia, biliousness, torpid liver, etc., which satisfy to some extent but leave the true nature of the lesion unrecognized. A safe rule is to consider that symptoms referred to the digestive tract are due to some organic change until proved otherwise. The too common custom of regarding them as functional as long as possible and regarding them as due to organic causes only when compelled to do so is the reason for many mistakes. In these obscure problems it is well to begin with the possibility that the gall-bladder may be involved. In all cases which are under suspicion there are some points which are of aid. The history of some acute condition which may require careful questioning to bring out, a long-continued history of gastric disturbance for which no evident cause can be found, and it is usually possible to decide if any organic lesion of the stomach or duodenal ulcer is present, should always be regarded as throwing suspicion on the gall-bladder. This sounds very simple, but the experience of everyone of us proves that we all need to have it repeated. Another point worthy of note is the study of the temperature curve in these doubtful cases, especially during an attack, on the surface apparently of digestive disturbance only. Infection enters into the problem in the majority of them and slight fever is not uncommon. Naturally this does not give us a diagnosis, but is an additional point of value when considered with other findings.

Turning to the question of functional disturbance of the gall-bladder we must confess that we have little accurate knowledge. It seems reasonable to suppose that this may occur without organic change, but this raises the question here as in other organs whether repeated functional disturbance may ultimately lead to organic change. In the gall-bladder should retention occur, for example, there is much chance of alteration in the bile which in turn may

lead to further disturbance. Meltzer[1] has put forward the mechanism of "contrary innervation" as an explanation in a very convincing way. In this particular case the muscles of the gall-bladder and the papilla are the antagonists. This may explain the mechanism by which the bile is at one time passed on to the duodenum and at another time stored in the gall-bladder. Of the factors that control this we know little. Judging from the working of the digestive tract generally we should expect that both chemical and nervous influences may play a part. Bound up with this is the question of the entrance of bile into the stomach. Probably reverse peristalsis of the duodenum plays a part in this. In over one-half of normal cases bile is found in the stomach, but it is apparently only in pathological conditions that it is found in the stomach throughout all the duration of a fractional test meal. With this is bound up the study of the factors which in the normal state influence the flow of bile.

For our present knowledge of gall-bladder disease we owe much to the surgeons who have solved many of the anatomical questions. But there is much to be done before our knowledge can be regarded as satisfactorily complete. In this the physiologist and the worker in clinical medicine should have the principal part. The improved methods of studying the duodenal contents offer much. But until we have a more complete knowledge of the physiology much of the pathology of the gall-bladder and liver must be obscure.

[1] Am. Jour. Med. Sc., 1917, cliii, 469.

THE ROENTGEN DIAGNOSIS OF GALL-BLADDER DISEASE *

By HENRY K. PANCOAST, M.D.

At the present time the roentgen diagnosis of gall-bladder disease is being approached more or less successfully from three aspects: (1) the direct determination of the presence of gall-stones by the roentgenogram, (2) the visualization of the gall-bladder in the same way, (3) and the detection of various effects of inflammatory conditions of the biliary passages upon adjacent portions of the gastro-intestinal tract. Each of these paths to a knowledge of existing condition deserves and requires separate consideration. Being far remote from an exact science this subject is the focus of considerable roentgenological controversy at the present time. It is obvious, however, that when presented for clinical and surgical interpretation the subject must be molded into an accurate and conservative statement of facts.

The direct roentgenographic determination of the presence of gall-stones has been one of the most difficult problems before the roentgenologist for many years. Were the detection of biliary calculi as accurate as that of urinary calculi, with its 5 to 10 per cent. of error, this means of diagnosis would be a great source of satisfaction to roentgenologist, internist and surgeon, to say nothing of the patient. Unfortunately this is not the case, and it is probable that the roentgen diagnosis will never have the same positive and negative values in the one as in the other. Trained

* Read April 4, 1917.

observation and perfection in technic have undoubtedly greatly increased the percentage of gall-stones found and definite characteristic shadows on the plate are of positive value in determining the diagnosis, but the negative diagnosis continues to be valueless. Nevertheless, the subject is on a sound scientific basis from the stand-point that we have an exact knowledge as to why such a small percentage of gall-stone shadows can be detected. The pure cholesterin stone has such little difference in density from the surrounding tissues that its shadow can rarely be differentiated. In fact, numerous writers have shown that in the case of a gall-bladder filled with bile and stones the calculi cast less dense shadows than that of the surrounding bile. Aside from differences in technic, powers of observation, and thickness of the patient the density of the shadows of biliary calculi is proportional to the calcium content. The percentage of lime salts may be exceedingly small, and, according to Case, the highest calcium oxide content in stones not recognized was 0.3 per cent., and the lowest in the recognized stones was 0.425 per cent. The shadow of a gall-stone does not depend upon its size. One of very large proportions may not show, whereas a very small one may show a dense shadow. Moreover, a cholesterin stone may be built up around a very small calcium-containing nucleus.

Statistics bearing on the accuracy of direct examinations are exceedingly difficult to compile, and for the most part are very misleading. It is only fair to base statistics on cases that have been examined roentgenographically and the diagnosis proved by careful inspection and palpation of the biliary passages at operation or postmortem. Even such statistics are unreliable unless they cover a considerable number of cases. We regard those recently reported by Case[1] as among the most worthy of conservative judgment. In 300 laparotomies by Kellogg, Harris, and Case at the Battle Creek Sanitarium, in which the gall-bladder was examined at the time of operation, gall-stones were found in 41. Of this number a positive roentgen diagnosis had been made in twenty, or 49 per cent. We would regard this as specially reliable because no account was made of negative roent-

gen and negative operative findings. It simply means that in 49 per cent. of the cases in which gall-stones were present they were detected roentgenographically. Many roentgenologists place the percentage as high as 75 per cent., or even higher, but we regard Case as one of the most careful and conservative of men and accept his statistics upon such a basis.

Considerable controversy still persists in reference to the justification of reporting "suspicious shadows" in the gall-bladder region. Pfahler, George, Case and others are insistent upon a distinct value in such reports, as "suspicious shadows" may be due either to gall-stones, thickened gall-bladder walls, or distended gall-bladder. If "suspicious shadows" are reported for the reason advanced by Case,[1] that "if note is made of them the surgeon will be more likely to exercise special care in palpating the gall-bladder at operation," there is ample justification for such a report provided its influence is manifest in this way only. Case also states that "no operation should be done on the strength of roentgen findings which are only suspicious unless clinical findings would seem to confirm the suspicion," and all conservative men must agree with this statement. There still remains considerable to be said on the other side of this argument, however, and much depends upon whether it is justifiable to make a direct roentgen examination of the biliary tract without a study of the gastro-intestinal canal as well. Certainly, the latter procedure might reveal something else responsible for the symptoms, and undoubtedly the examination is greatly enhanced by a complete study of both tracts. Case's statistics[1] show that whereas it is possible to show gall-stones in 49 per cent. of cases, evidences of gall-bladder disease, with or without stones, were demonstrated in 88 per cent. when a complete study was made. According to similar statistics by George,[2] in 85 per cent. of cases in which gall-bladder trouble was found at operation it was indicated one way or another during the roentgen examination. If we go no further than the direct examination for gall-stones we believe that we either do or do not show them. There are so many conditions or structures whose shadows may possibly simulate gall-stones and

be regarded as "suspicious" that we do not believe a report of "suspicious shadows" has any direct diagnostic value. It would seem to border too much on taking a chance shot, which is, however, usually a fairly good one, because in the class of patients usually referred for gall-stone examinations there are fairly good chances of gall-bladder trouble any way. Personally, we believe that when the single examination is made the report should be either "positive," or "the examination shows no definite evidence of gall-stones."

Visualization of the gall-bladder was recently advanced by George[2] as positive evidence of pathology in that organ. He believes that the normal gall-bladder cannot be visualized as a rule, and has never in nearly 100 cases shown the gall-bladder and been proved wrong.[3] There is considerable controversy over the value of this observation, and it may prove to be like a passing fad; but the consensus of opinion seems to be that if the gall-bladder is visualized accurately it is pathological in the majorty of cases. In the very few instances in which we have visualized it with certainty during the past few months it has been found pathological at operation. The visualization should be accurate to be in any way dependable, and the plate should show the edge of the liver, the lower pole of the kidney, and a distinct gall-bladder shadow. This must, of course, be differentiated from any localized hepatic enlargement from any cause.

The influence of gall-bladder disease may be manifest through the effects of pressure or adhesions upon the contiguous portions of the gastro-intestinal tract. Enlargements of the gall-bladder from retention or growth may displace the duodenum or stomach, widely separate duodenum and hepatic flexure, cause permanent shadow defects in the duodenum or stomach, or obstruct the duodenum. Inflammatory conditions of the biliary tract are one of the most prolific causes of adhesions in the right upper abdomen, and the effects of these are manifest upon the stomach and duodenum and possibly the hepatic flexure. Ulcer of the duodenum or stomach may produce adhesions in the same localities, but each of these conditions has its characteristic roentgen features.

Conclusions. Disease of the gall-bladder may be determined by direct examination for gall-stones, visualization of the gall-bladder or by the detection of effects of disease or growths upon adjacent portions of the gastro-intestinal tract.

Conservative estimates place the number of gall-stones that may be detected roentgenographically at about 50 per cent. Negative findings are of no diagnostic value. "Suspicious shadows" should never influence the diagnosis except possibly when there is strong clinical evidence of gall-bladder trouble. The visualized gall-bladder is still of doubtful value. The combined direct examination of the gall-bladder in combination with an examination of the gastro-intestinal tract is of considerably more value than the first alone.

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DISCUSSION ON PAPERS BY DRS. GIBBON, McCRAE AND PANCOAST

Dr. Joseph Sailer: The problem of gall-bladder disease as it affects the physician, particularly from the stand-point of the surgeon involves two things:

1. The possibility of a failure of diagnosis at the time of the operation. This I do not believe is really as common in connection with gall-stone as is a mistake in diagnosis at the time of operation in connection with duodenal ulcer. It is far easier to overlook duodenal or gastric ulcer if the physician does not explore the mucous membrane in a doubtful case than to overlook gall-stones. Yet occasionally it does happen that at operation when the clinician has suspected gall-stone it is not found.

2. The possibility of securing an operation which is final. This is not perhaps as easy as it seems. At least my own personal experience has been that in a number of cases the patient has continued to have pain. In two instances there was a sinus which opened and closed

indefinitely and each time the sinus opened there was severe pain; the blame being placed entirely upon the physician in both instances and not upon the surgeon. In one case reoperation relieved the patient. In another case, packing the sinus had an equally favorable effect. Otherwise the question of diagnosis of these conditions is purely medical. The more I see of gall-stone disease the more convinced I am that recurrent attacks of colic in the upper portion of the abdomen mean gall-stone in the vast majority of instances; and, because the attacks of colic are not particularly typical, or because in the internal there are no very definite signs or symptoms of the condition, frequently for long periods of time the disease is not suspected. In the case shown by skiagraph in which there were four stones in the gall-bladder and three in the diverticulum springing off from the cystic duct at some little distance from the gall-bladder the patient had suffered with colic for thirty years. During that time she had been treated by a considerable number of physicians in Philadelphia, each one a man of unusual distinction and prominence, and yet it was not until an x-ray was made that a positive diagnosis of gall-stones could be reached. When operation was performed the patient was immediately and permanently cured. In another case the patient had suffered for three years with extremely violent attacks of pain supposed to be due to a variety of causes. It was only when in one of these attacks I had the opportunity of seeing the patient with his family physician, Dr. Rhoads, of Germantown, and observing that as the pain subsided there appeared a definite localized point of tenderness in the region of the gall-bladder that we reached a diagnosis, which was immediately confirmed by operation and the removal of several large stones. I feel, therefore, that recurrent colic for a period of years with pain in the upper part of the abdomen should lead to a strong suspicion of gall-stones. This seems almost like an obvious statement and yet cases I have seen have shown that we are very prone to overlook this possibility and to regard each particular attack of colic as something peculiar to itself.

There are many factors in our therapeutics brought up by the paper of Dr. McCrae. The question of focal infection has interested me a good deal. While it is one of importance I think there is danger that this importance may be overemphasized. In my service at Blockley practically every patient entering has pyorrhea and yet we do not see to such an extent as we would expect the conditions ascribed to focal infection. There is a very fair dental service at Blockley, yet attention to these conditions has not been followed by the results expected from the relief of focal infection. I have collected a number of cases in which I made cholesterol tests. One patient had recurrent attacks of colic over a

long period of time and has had five abdominal operations for various conditions. The *x*-ray made by Dr. Pancoast is positive, and operation for gall-bladder disease is to be done. The cholesterol count in this case as 147 which is low. From 140 to 148, according to Hawk, is the normal content of human blood. In a second case with recurrent attacks of gall-stone colic the white cell count was 14,200; cholesterol 169, which is also low. Here the *x*-ray finds were strongly positive of gall-bladder disease. In a third case the results of our study have been extraordinary. The white blood cells numbered 8600; there has been colic with all the typical physical signs of gall-bladder disease, with a cholesterol count of 318, nearly twice the normal maximum and negative *x*-ray findings. In a fourth case there were 12,800 leukocytes, a strongly positive *x*-ray with repeated attacks of colic which in some respects simulated attacks of duodenal ulcer; cholesterol estimate 230. Operation was advised. On the contrary, in a case of chronic jaundice of three years' standing for which there seemed to be no adequate explanation the patient had over 5,000,000 red blood cells; 82,000 white blood cells; a normal differential count and a cholesterol estimate of 171. There was no evidence from the history or physical examination that the patient had had gall-stone colic. Just as a matter of interest Dr. Schnable estimated for me the cholesterol in several cases of pernicious anemia and found it to be subnormal. It is a matter of considerable interest to attend to the condition of the heart in these cases. I am inclined to believe that there must be, as Babcock has suggested, some relationship between the poison which is liberated by the gall-bladder and the heart muscle. There are certain factors in these cases which are at times puzzling. Two years ago a case diagnosed cholecystitis was found to be echinococcous infection of the liver. In another case there was apparently a suppurative condition around the hepatic flexure of the colon. The patient was in very bad condition, operation was hastily done and the source of the suppuration not found. The patient died and autopsy was not obtained. What actually occurred I do not know; the gall-bladder at the time of operation seemed to be normal. In another case which puzzled me Dr. Pancoast made *x*-ray studies and thought he discovered a calculus of the pancreas. A diagnosis of chronic pancreatitis in another case was confirmed at operation by Dr. Deaver. We thought there might be gall-bladder defect and Dr. Deaver discovered a closure in the hepatic duct which has been entirely relieved by operation, although at the time of the operation Dr. Deaver considered such relief impracticable.

Dr. Walter G. Elmer: An important phase of this question is the occurrence of cholecystitis in little children. Children of only a few

years of age may sometimes suffer from catarrhal infection of the gall-bladder and cystic duct. The temperature will sometimes rise to 103° F., accompanied by abdominal pain and local tenderness; the distended gall-bladder can be distinctly palpated. After a time, the thick plugs of mucus which are occluding the ducts are expelled, the gall-bladder is relieved, the temperature subsides to normal and the pain and tenderness disappear. After an interval of two or three days the condition recurs. Such an illness may last for from two to five weeks and often presents quite a difficult problem for solution. In one case the Widal reaction became positive rather late in the disease, establishing the diagnosis of typhoid fever infection of the gall-bladder, although during the intervals when the gall-bladder was not distended and was draining properly, the temperature of this girl was normal.

Dr. S. Solis Cohen: Cholecystitis, in the course of an acute infection, was illustrated in the case of a man admitted to the Philadelphia General Hospital with acute lobar pneumonia, who suddenly developed, together with great increase of leukocytosis, symptoms suggestive of pleural empyema. Examination, however, revealed rigidity of the upper right quadrant of the abdomen, and this, with slight icterus, absence of physical signs of effusion and presence of pain in the hypochondrium led to the diagnosis of empyema of the gall-bladder. The patient's family at first declined operation, and when consent was obtained he was so nearly moribund that we had but slight hope of success. The operation which was done by Dr. Thos. Stellwagen, Jr., under local anesthesia, proved to be difficult, the gall-bladder being hidden—that is to say, imbedded in the lower surface of the liver. It contained a considerable amount of pathological material, apparently not pus, but thick bile. The colon bacillus was found, but not the pneumococcus. Recovery was slow but sure.

Dr. Gibbon (closing): Of the 200 cases referred to, in only about 10 per cent. of the cases in which stone was found had the patients had typhoid fever. In only 33 per cent. was there the definite statement that the patient did not have typhoid. In one interesting case of a woman who had gall-stones the typhoid bacillus was found in the stones and yet the patient definitely stated that she had never had typhoid. When convalescing from the operation she passed through a typical attack of typhoid fever.

I am very much interested in Dr. Pancoast's statement of what the roentgenologists have done in regard to diagnosis. I think we may look to them probably more than to the physiological chemists for aid in diagnosis.

We all know of many cases which have dragged along for years until diagnosis has been made by the *x*-rays. In the case of one man whose illness had extended over ten to fifteen years and who had been in the hospital for various treatments. A bright woman physician saw him in one of his attacks and had an *x*-ray examination made which showed seventeen gall-stones. These were perfectly easily removed and yet the man had suffered all these years. In another case which Dr. Cheston and Dr. McCrae will recall very well, all the symptoms pointed to the kidney, when the *x*-ray showed three stones in the gall-bladder. Cases like these show that we must look to the roentgenologist for help. What Dr. Pancoast has said about a negative diagnosis being of no value is perfectly true. I do not think cases should be examined only for gall-stones but that the gastro-intestinal tract should be investigated as well. In one of my cases cancer of the stomach was associated with gall-stones. Regarding the continuance of symptoms mentioned by Dr. Sailer, my experience is that the more extensive the pathology at the time of the operation the more complete is the recovery. My opinion is that removal of the appendix, fixation of a floating kidney and the removal of the coccyx do not cure gall-stone disease, nor should the removal of the gall-bladder be done unless there is a distinct pathological lesion.

RECENT OBSERVATIONS ON BLOOD TRANSFUSION[1]

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Since the publication of our paper on the indications, results and general management of blood transfusion, in July, 1915, there has been a great deal of active work on the subject, and many advances have been made. We have been able to observe over 200 additional cases ourselves, and while we have not found it necessary to change any of our ideas concerning the indications for transfusions, there are a number of new points we have learned concerning the use of transfusion in particular diseases, and we can offer further clinical experience upon a number of questions on which our clinical experience at the time of the previous paper was relatively limited.

Methods of Performing Transfusions. On the whole the technic of transfusion has improved considerably within the last two years, and this is of very great importance, because it makes it impossible now to apply transfusion in many cases in which formerly the operation would have been considered too difficult or troublesome. The most important change is the complete disappearance of direct artery-to-vein or vein-to-vein transfusion, with the various surgical devices that were used for that operation. As the result of the work of a number of different men, it has

[1] Read April 27, 1917.

become clear that there are several different ways of removing blood from the donor and then injecting it into the patient without seriously altering or injuring it. At the time that our previous paper went to print the syringe method of Lindeman had been recently introduced and was the most popular of the indirect methods. Certain difficulties involved in it were overcome by the method of Unger, which, like the Lindeman method, employs syringes, but uses them with a two-way stop-cock apparatus, which is very simple and ingenious in construction. A large proportion of the transfusions that we have seen in the last two years has been done with the Unger apparatus and, on the whole, the method is very satisfactory. The chief objection to it is that the preparation and setting up of the apparatus itself consumes considerable time, so that the method is not a very good one for emergency transfusions. We have given up the modification of the Unger method, which required the chilling of the syringes with an ether spray, as it has turned out to be unnecessary.

Undoubtedly the most important modification of methods of transfusion has been the introduction of sodium citrate as an anticoagulant, almost simultaneously and independently in 1915 by Hustin, of Brussels, by Agote and by Weil and by Lewisohn, of New York. The citrate method now exclusively used is that of Lewisohn. He showed that a very small percentage of sodium citrate, usually about 0.2 per cent., is sufficient to prevent coagulation, and the small amounts of sodium citrate required to make this percentage are well below the toxic dose.

We have seen citrate transfusions a great many times and believe that the method is a most valuable one, and has come to stay. When the use of sodium citrate was first introduced the fear was expressed that it would tend to make the blood incoagulable, since it was an anticoagulant. The subsequent work of Weil, Lewisohn and others showed that instead of this the blood coagulation time becomes somewhat shortened directly following the transfusion of citrated blood. The work of one of us (Ottenberg) on a case of hemophilia showed that while there might be a marked temporary shortening of coagulation time in hemophilia there was,

twenty-four hours later, a decided prolongation of coagulation time. Whether this is the case in other conditions has not yet been discovered. On the whole, however, we can say that, except possibly in hemophilia, there seems to be no contra-indication to the use of sodium citrate in hemorrhagic cases, and in no case in which it has been used has there been any development of a hemorrhagic tendency. Subsequent experience has shown that while the 0.2 per cent., which Lewisohn recommended, would keep the blood of the majority of persons from coagulating, it would occasionally fail to do so with certain individuals, and he himself, as well as others, uses a slightly larger amount of citrate. After having the experience of having the blood clot with 0.2 per cent., we ourselves have come to use 0.3 per cent. as a routine. This still remains well below the amount of citrate, which can give toxic effects. There has been some criticism of the use of sodium citrate on account of the chill and rise of temperature which it was asserted frequently followed. Dr. Lewisohn has kept records of 129 citrate transfusions and has been kind enough to give us the figures. They show a chill or a rise of temperature above 101° F. in 19 cases; that is, 15 per cent. Since, as we have stated in our previous paper, such chills and rises of temperature occurred in about 10 per cent. even of direct artery-to-vein transfusions, it does not appear as though the use of sodium citrate was greatly at a disadvantage. We have seen 1 case in which the reaction was so severe as to be nearly fatal, but this was a case of pneumonia in which the crisis occurred simultaneously with the reaction, and we are not certain whether the profound effects were due to the citrate or to a combination of several factors. The case will be further discussed below under the subject of contra-indications to transfusion. From the experimental work of others which has shown citrates to be markedly toxic to the kidneys, as well as from our own clinical experiences, we believe renal disease, even if not very marked, to contra-indicate the use of sodium citrate.

There are several other methods which have been introduced and have had a considerable amount of popularity, but with which we have had no experience. Among these may be men-

tioned those of Kimpton, of Satterlee and Hooker, and the transfusion of defibrinated blood (Moss).

Regarding the use of defibrinated blood, we are not at all sure that the last word has been said. The use of defibrinated blood was condemned in the older literature as well as by ourselves, because the reintroduction of a large amount of defibrinated blood meant the introduction into the body of a large amount of serum which of course contains thrombin (fibrin ferment). It was believed that this occasionally led to intravascular clotting and fatal results. We now know that in all likelihood most of the very severe reactions and fatal results which occurred in the earlier periods of transfusion were due rather to the occurrence of agglutination or hemolysis in the circulation, and animal experiments have shown that it is possible to transfuse considerable amounts of defibrinated blood with safety. We know that the body possessed considerable reserve power to neutralize introduced thrombin in the form of circulating antithrombin, and it seems to us that now that the question of reactions due to incompatibility between the blood has been definitely settled and that such dangerous reactions can be avoided by careful preliminary tests, the question of the use of defibrinated blood should be cautiously reëxamined. Of course, in cases in which the transfusion was done for a hemorrhagic condition it would probably still be inadvisable to use defibrinated blood, because it lacks two of the chief ingredients necessary for coagulation—namely, fibrinogen and blood platelets.

On the whole, at present we believe that it is desirable to have at commond two methods, the syringe method of Unger and the citrate method. In cases in which the additional trouble and technical difficulties of the Unger method are no objection to its use we prefer to use it, as we are then certain that the introduced blood cells cannot be altered or changed in any way by the presence of a foreign chemical substance. On the other hand, in a very large number of cases in which speed or ease of accomplishment of the transfusion are important factors or make a transfusion possible where otherwise it would be almost impossible, we do not hesitate to use the citrate method.

An important addition to the methods of transfusion is the use of the longitudinal sinus in infants introduced independently by Tobler and by Helmholtz, of Chicago, in 1915. We have used this method once, with success, in a case of melena neonatorum. It is important to remember in case there is difficulty in finding a superficial vein in an infant that the longitudinal sinus has been demonstrated to be easy and safe to use.

Prevention of Accidents. One of the important subjects which is now to a considerable extent cleared up is the prevention of accidents after transfusion. It is now recognized that the majority of the accidents which formerly followed transfusion, and which until recently caused transfusion to be regarded as a dangerous and serious procedure, were due to incompatibility between the blood of patient and that of donor. These incompatibilities were first discovered and studied by Landsteiner in 1901, and his work and that of subsequent investigators showed that all human beings belong to one of four groups, that the blood of all individuals belonging to the same group is compatible, while the blood of any two individuals belonging to different groups is incompatible, the incompatibility consisting of agglutination or hemolysis, or both, of the cells of the one individual by the serum of the other. These groups, as was first pointed out by one of us in 1909, are hereditary, but since in any given instance a child inherits from either father or mother, and since if the parents happen to belong to different groups, the child cannot at the same time belong to both of them, it is necessary, even in a case of close blood relations, such as brothers and sisters or parent and child, to perform the tests. However, in such case of close blood relationship the likelihood of two individuals belonging to the same group is greater than if they are not close blood relations, and this is what led to the old clinical observation that serious accidents following transfusion were less likely if the blood of a near relative was used. We know of several accidents following transfusions in cases in which no tests were done, but a near relative was used on the assumption that his blood would be suitable. The desirability of doing such preliminary tests before all transfusions was first

pointed out by one of us in 1908, and subsequent clinical observation has demonstrated that this is not only desirable but a necessity, so that now there are few men who have had any experience with transfusion who would be willing to transfuse (except in the most urgent cases) unless the preliminary tests had shown that donor and patient were compatible. This opinion, for example, is expressed recently by McClure, who in a much earlier paper had expressed the contrary opinion. In our own experience, now extending over more than 500 cases, we have never seen results which could be attributed to agglutination or hemolysis in cases in which careful preliminary tests had shown donor and patient to belong to the same groups.

It was shown experimentally by one of us in 1911 that the body contains certain sources of protection against agglutination, and for this reason the transfusion of blood of a different group from that of the patient is not invariably followed by bad results. In particular, it was shown that if it is impossible to find a donor belonging to the same group as the patient, it is practically safe to choose a donor whose serum agglutinated the blood cells of the patient, but dangerous to choose one whose cells are agglutinated by the blood serum of the patient. This has now become generally recognized. In practice today we usually test for agglutination only, since, as was shown by Moss, of Johns Hopkins, the hemolysins occur in groups which correspond to the agglutinin, and hemolysin, though less regularly present than agglutinin, is never present unless there is also agglutinin, so that by excluding agglutination one excludes both.

There have been a number of new methods introduced for the performance of the agglutination tests. Of these the most interesting is the method proposed by Weil and elaborated by Rous, of making mixtures of citrated blood. The method has the advantage that it dispenses with the centrifuge, but the disadvantage that it requires a microscope. We have used the method to advantage once in an instance in which the tests had to be done in an inaccessible country house, to which, however, a microscope could be transported. In the use of the Rous method we have found that

due to the presence of the unagglutinated cells belonging to the plasma, which possesses agglutinative power; agglutination is much more difficult to observe than in those cases in which a serum containing no cells is mixed with the cells of the opposite individual, and we are not sure whether the method can be relied upon to detect the weaker grade of agglutination (which nevertheless, if undetected, may lead to serious results). For this reason we prefer one of the macroscopic methods. It would seem desirable to acquire some method which would do away with the use of heavy laboratory apparatus like the centrifuge and microscope and would make it possible to do tests at the bedside or in the patient's home. The method of Brem comes nearest to meeting these requirements, but still necessitates that one wait a long time for the separation of serum from the blood clot or use a centrifuge to accelerate it. We now use a simplification of Brem's technic in our own work. We do away with hanging drops and merely mix one drop of serum with one drop of cell emulsion on a glass slide, and, with occasional tilting of the slide from side to side so as to mix the cells, watch for twenty minutes. Within this time, in fact, usually in one or two minutes, agglutination if present can always be seen with the naked eye.

In actual practice in large cities, transfusion donors are drawn from the class of day laborers and are generally men out of work. Many of them are used for transfusion repeatedly at intervals of several months. Brem, of San Francisco, has proposed that such donors be grouped, that is to say, that it be determined to which one of the four groups of human blood the blood of each donor belongs. With the appearance of a new patient who needs transfusion time can then be saved by testing the blood of the patient with the blood of persons whose grouping is known and determining to which group the patient belongs by finding out with which one of these persons' blood his blood is compatible. Then it is only necessary to send for a donor belonging to the same group. Minot pointed out that it was only necessary to have on hand preserved serum of individuals belonging to Groups II and III in order to determine, with two simple mixtures for each new

individual, to which of the four groups his blood belongs. This is the most simple and rapid method of determining groups, and we have found it of great advantage for emergency work. It is to be specially recommended for war surgery.

It is not necessary to obtain blood cells separately in citrate solution for the tests, and the use of citrate has the disadvantage that sodium citrate is not always at hand in emergencies. Salt solution, on the other hand, can be improvised anywhere. We can always obtain enough cells to make up a fresh emulsion of red cells in saline solution by gently breaking up the centrifuged clot and pipetting off a small amount of the red cells so liberated and suspending them in saline solution.

One important new point on which we would lay stress is the necessity of doing tests again if transfusion is repeated even if the same donor is used. We have seen several instances in which a patient developed new agglutinative or hemolytic power toward the blood cells of a donor to whom he had not originally been agglutinative or hemolytic. In one of these cases, a young man, suffering from hemophilia, a first transfusion of 50 c.c. by the syringe method was followed by no reaction whatever, and the tests showed absence of hemolysis or agglutination. A month later an identical transfusion (also by the syringe method), of the same amount of blood, was followed by an immediate reaction, consisting of partial collapse, nausea and vomiting, generalized urticaria, violent headache and hematuria. Blood obtained from patient and donor a few days after this occurrence showed that the serum of the patient was now strongly agglutinative toward the cells of the donor. It was not determined whether the agglutinin present was due to the patient having changed his group (a hitherto undescribed occurrence) or to the development of a new immune iso-agglutinin (having no relation to the normal iso-agglutinin) as the result of the first transfusion.

The occurrence of phagocytosis of red blood cells in the circulation following transfusion was first described by Hopkins, and was shown by one of us (Ottenberg) to be a regular accompaniment of agglutination or hemolysis in the circulation and not to occur

otherwise. An extremely interesting case illustrating the development of new antibodies against blood with which the patient's blood had primarily been compatible is reported by Brill. In this case, one of pernicious anemia, in which a splenectomy and a transfusion were done, there was no unfavorable reaction at the time of the transfusion, but several weeks later the patient, whose blood was studied by Rosenthal, showed spontaneous phagocytosis of red cells by the monocytes as well as by the polynuclear leukocytes, and at the same time hemoglobinuria; she died shortly after. So far as we can see there was no way of preventing this occurrence, but as our other experiences in pernicious anemia show, it is a very unusual thing.

Besides the examination of donors as to the compatibility of their blood with that of the patient there are a number of other important points in the selection of donors which should never be omitted. Unless the donor is a close relative of the patient and understands the situation fully, or other circumstances are such as to make a syphilitic infection highly improbable, the Wassermann test should always be done. We have had a surprising number of positive results among donors so tested; probably 5 per cent. of the men who answer advertisements in New York show a positive Wassermann reaction. We have been informed by a reliable colleague of one instance in which a man whose Wassermann reaction was positive and had recently become so was used for transfusion. In this case the patient died of the original condition from which she was suffering shortly after transfusion, and we do not know whether or not she would have subsequently developed symptoms of syphilis. The donor had been used for transfusion some three months before, and when he reapplied as a donor for transfusion it was not considered an urgent necessity to repeat the Wassermann test which had been negative on the previous occasion, and the test was not done until after the transfusion. It is possible that he had acquired syphilis in the interim between the two transfusions.

The physical examination of donors for the exclusion of tuberculosis and heart disease should be performed, not only in the

interest of the patient, but also of the donor, and when time permits a blood smear should be examined as the case of transmission of malaria described by Bovaird shows.

The repeated use of the same donor is permissible and, in fact, advantageous, providing the interval between transfusions is long enough to allow the donor to completely recuperate. We believe that a second transfusion should never be done under a month or six weeks at the minimum, and that the interval between subsequent transfusions should be longer, and hemoglobin estimations should be done before the subsequent transfusion and no donor used whose hemoglobin is under 80 per cent.

In selecting donors size is important, as large men stand the withdrawal of considerable amounts of blood, other things being equal, more easily than small men; but weight is not so important, because, as is well known, adipose tissue has a relatively small blood supply, and the fat man has not very much larger blood volume than a much lighter man of the same height. From the above experience, in which probably a donor acquired syphilis between transfusion, we would urge the importance of reëxamining each donor completely both as to blood and as to physical condition before each transfusion if the same donor is used more than once. The signing by the donor of a legal blank relieving the patient and the surgeon from further liability and stating the amount of money that the donor receives is important, as we have known of an instance in which a donor returned and annoyed the patient's family by efforts to blackmail them to give him more money. Donors can be assured that in the great majority of cases, at least in which less than 1000 c.c. of blood are taken, they will be able to leave the hospital or the patient's house the same day and to go to work the next day. Likewise, with the improved methods of transfusion we can practically always now promise them that they will have no wound or mark as the result of the transfusion.

Modifications of Transfusion for Special Purposes. Within the last few years there are certain special procedures which have been recommended for the application of transfusions in

infectious diseases, toxic conditions or under the circumstances of war. These special modifications are mostly new and not yet very well tried out, but they are important and deserve attention.

The immunization of donors against a particular organism by which the patient has been infected has been proposed and carried out in a number of different infectious diseases. In our former paper we described such a transfusion from an immunized donor in a case of bacterial endocarditis. The result in that and in subsequent cases that we have seen was in no way superior to that with donors who had not been immunized. McClure describes such transfusions in cases of typhoid fever; one of the patients recovered but the other one died of hemorrhage. The use of the blood of convalescents or of persons who have recovered at various times in the past from the infectious diseases has been proposed in scarlet fever and poliomyelitis, and in fact would seem deserving of a trial in many other infectious conditions.

The removal of a considerable amount of blood from the patient before transfusion would seem, on theoretical grounds, to be indicated in transfusion for toxic conditions, and in fact it is practised in transfusion for illuminating gas poisoning. On the basis of the one very remarkable result obtained by Neuhof, and reported by us in a preceding paper, it would seem worth trying also in transfusions for chronic leukemia. Even in pernicious anemia, if it is possible to transfuse a large amount, it would seem desirable to remove some blood before transfusion. Hedon, in 1902, proposed that in various toxic conditions in which the toxic substance is supposed to be dissolved in the blood plasma, the patient be bled repeatedly, the red blood cells washed in sterile saline and reintroduced into the body, as it has been shown that blood cells so treated do not lose their vitality; yet in this way a considerable amount of the toxic substance can be removed. So far as we know this has not yet been put to practical use, the difficulty being that in most toxic conditions in which the offending substance is carried by the blood plasma it is rather rapidly removed by the tissues. Still, the possibility of doing this should be kept in mind in order that when suitable cases for it arise it will not be forgotten.

The important work of Peyton Rous on the preservation of blood cells by the addition of glucose and sodium citrate has opened up considerable possibilities for emergency transfusion under conditions of warfare. We do not know whether this has as yet found practical application. Even without the use of the special solutions of Rous, Weil showed that citrated blood could be kept for several days and then transfused into the person from whom it had been removed without doing any harm. Under the conditions of warfare, in which many wounded die of pure hemorrhage, it would seem to be possible to have on hand in hospitals, at suitable locations, supplies of citrated blood for emergency transfusions. Experience with transfusion in hemorrhages shows that a very much smaller amount of blood than a patient has lost is usually sufficient to save life, and it seems likely that many lives could be saved in this way. It would even be possible in cases in which the patient was not in such desperate condition that twenty to thirty minutes' waiting would injure his chance of surviving, to perform the simple agglutination test and select a specimen of blood for transfusion whose cells were compatible. For emergency purpose it would be advisable to have on hand a considerable supply of blood belonging to Group I, the cells of which could be washed aseptically and injected suspended in saline solution after having been freed of their plasma. (Group I, according to Landsteiner's classification in 1901, is the group whose cells are inagglutinable and whose serum agglutinates cells of all persons belonging to other groups. Moss, in 1910, somewhat confused the subject by introducing a new and different terminology for the groups, naming Group I Group IV, and *vice versa*). Since the blood cells of Group I are not agglutinable the danger of a serious reaction when such cells were used in emergency transfusions would be averted.

In this connection we have permission to refer to some as yet unpublished observations of Dr. Coulter, of the Presbyterian Hospital, New York City, who has three times transfused such washed inagglutinable cells into patients belonging to Group II or III. In one case, a grave anemia bordering on the pernicious

type, he found that such a transfusion of the washed cells of 500 c.c. of blood produced a far greater and more permanent improvement of the condition than several preceding transfusions of whole blood belonging to the same Group I. One of the most interesting points in his observations of this case was that three days after the transfusion the spleen, which had not been previously palpable, become enlarged to one finger's breadth below the free border and very hard, and it seems as though in this case the red blood cells were very likely held and phagocyted in the spleen and acted rather as a stimulus to blood formation than by their persistence in the circulation.

Since the general application of the indirect methods of transfusion it has been possible to measure the amount of blood transfused of course far more accurately than it was possible to do with the old direct transfusion even by the method of calculation which we introduced in 1914. Nevertheless, the principle of this calculation is still very useful in determining the amount to transfuse in a given case. This is of importance, for example, in infants in whom it is advisable to calculate approximately the largest amount of blood which it is safe to transfuse (unless the infant is suffering at the time of a transfusion from acute hemorrhage, in which case it is desirable to replace as much of the blood as possible). It is always wise not to transfuse over one-fourth as much blood as the infant presumably has. In cases of chronic anemia, in which it is desirable to raise the hemoglobin content as much as possible, one can by the use of the calculation determine beforehand how much rise in hemoglobin percentage to expect from the given amount of blood, or conversely how much blood will be required to produce a certain rise in hemoglobin which is desired.

The general tendency has been to do smaller transfusions but to repeat them, and this has advantages both for the patient (since the reaction produced by a small amount of blood is never so severe as that produced by a large amount of blood) and for the donor. On the other hand, in pernicious anemia, we have not seen such good results from the very small transfusions which were formerly advocated for the purpose of stimulating blood

production, and we believe that in most cases enough blood should be transfused to produce a decided rise in hemoglobin percentage and an immediate improvement in the patient's general condition; in adults usually between 500 c.c. and 1000 c.c. will do this. In acute hemorrhages of course it is desirable to replace as much of the lost blood as possible, but this seldom can be done, at least from a single donor, and we generally have to content ourselves with transfusion of about 1000 c.c.

I. INDICATIONS FOR TRANSFUSION

We will follow the classification used in our former paper.

TRANSFUSIONS FOR SIMPLE HEMORRHAGE. (*a*) *Gastric and Duodenal Ulcer.* The general conclusion in the earlier paper that the cases in which transfusion is indicated are those of repeated or prolonged hemorrhage in our experience still holds good, and the fact that hemorrhage is still going on is not a contra-indication to transfusion, since in many cases transfusion immediately seems to check the hemorrhage.

(*b*) *Dysentery.* We have no new observations.

(*c*) *Typhoid Fever.* As stated in our previous paper the indications for transfusion in typhoid fever are hemorrhage and the exhaustion of toxic and prolonged cases. Transfusion will not of course stop hemorrhage from an open artery, but in cases in which the hemorrhage is not immediately fatal, transfusion helps to restore the patient already weakened by disease to a condition where recovery is possible, and in our experience has undoubtedly saved lives. The first appearance of blood in the stools should be a signal for obtaining a donor and having him on hand for emergencies.

(*d*) *Ectopic Pregnancy.* When transfusion can be done in time this is undoubtedly a very important field for its application. These are the cases in which often transfusion has to be done without preliminary tests. Reference should be made to an ingenious idea of autotransfusion suggested by Thies and used by Lichtenstein. This consists of the removal of the free blood in

the peritoneal cavity, the straining off of any blood clots present and transfusion of the blood into the vein of the patient. This is practically a transfusion of the patient's own defibrinated blood. It has been done ten times by Thies and Lichtenstein, with excellent results.

II. TRANSFUSIONS IN CONNECTION WITH SURGICAL OPERATIONS.

(*a*) *Preliminary to Operation.* Transfusions in debilitated subjects before surgical operations have become practically a routine matter on the surgical service of Mount Sinai Hospital. They so clearly seem indicated that little more needs to be said concerning them. The question often arises how soon after the transfusion ought the operation to be done. In general we believe that when the operation is not urgent it is better to wait two days, so that the patient can recover from any post-transfusion reaction that may occur, instead of having this coincide with the shock of the operation.

(*b*) *For Postoperative Hemorrhage.* The indications are clear and we have no further suggestions to make.

(*c*) *For Shock.* In our previous paper it was pointed out that the poor results in clinical transfusion for postoperative shock were probably due to delay before the transfusion could be performed. Realizing this, many of the surgeons are now making a practice of having a donor in readiness and present at all operations which it may be anticipated will involve unusual degrees of shock. This practice is to be highly commended.

III. TRANSFUSIONS FOR THE CURE OF HEMORRHAGIC CONDITIONS

The immediate relief of these conditions is almost invariable. Unfortunately, in many cases the relief is temporary and transfusion has to be repeated, while the true hemophiliacs and the chronic purpuras, having learned the value of transfusion, return to us, from time to time, as new accidents occur, for retransfusion.

IV. TRANSFUSION FOR BLOOD DISEASES

1. *Pernicious Anemia.* The general conclusions of the preceding paper have continued to hold good in our experience. Transfusion does not cure pernicious anemia, but it frequently induces a remission and undoubtedly prolongs life. We have under observation at present several cases which have had so long a course and so many remissions as the result of repeated transfusion that we have no doubt that their lives have been greatly prolonged as well as made comfortable by the transfusions.

In general, we believe that transfusion in order to be successful in pernicious anemia has to be resorted to more frequently and persistently than it has been. These patients have not the power of generating blood as rapidly as it is destroyed, but, excepting in the cases with severe toxic symptoms, which succumb very rapidly to the disease, it is possible by repeated transfusion to supply enough blood to keep the patient above a certain dangerous level. Our experience leads us to suggest that cases of pernicious anemia be systematically and persistently treated on this plan: Three or four donors with blood compatible with the patient's blood should be found. (The blood of the one used should be tested again of course before each transfusion.) The patient's hemoglobin percentage should be watched, and as soon as it begins to retrogress a transfusion should be done at once. If the transfusion fails to produce a remission and the hemoglobin percentage sinks within a few weeks to what it was before the transfusion, another transfusion should at once be done from a different donor, and a donor who has once thus failed to benefit the patient should not be used again for that patient. If after a number of transfusions it is found that the period of improvement produced by transfusion is very short, splenectomy should be performed, and then transfusion again reverted to. We have 1 case in which the patient's hemoglobin rose from 15 per cent. before transfusion to approximately normal and did not go down again below 90 per cent. for two and a half years. We have another patient who has

been kept alive for seven years by splenectomy and intermittent transfusion on the plan outlined above.

2. *Leukemia.* In acute leukemia transfusion is of only very temporary benefit.

In chronic lymphatic leukemia transfusion undoubtedly exerts a certain beneficial effect both as to symptoms and blood picture, and is worth using. We have repeatedly made the observation, which was pointed out by Packard and Ottenberg in a recent case, that the transfused polynuclear cells persist in the blood only a very short time in these cases.

A rather remarkable group of cases which have been variously described as sublymphemic leukemia, leukopenic lymphemia and aleukemic leukemia deserve special mention. Probably this is a heterogeneous group. Some of the cases are cases of true leukemia in which the leukocyte count is temporarily very low; others are probably toxic in origin and often tend to recover; others probably belong to the group of aplastic anemias.

We have had one very interesting case of this class in which the lymphemic blood picture occurred immediately after an attack of acute malaria and in which a transfusion seemed to determine an abrupt turn toward the normal followed by ultimate recovery.

V. TRANSFUSIONS FOR INFECTIOUS DISEASES

In infectious diseases the indication for transfusion is either to sustain the general strength of the patient, as, for example, in protracted typhoid or suppurative diseases, or to transfer a quality of blood which has superior antibacterial powers. Concerning the usefulness of transfusion as a supporting measure in the protracted cases there is no longer any doubt, and it should be used more often than it is. There had been a number of scattered reports of the use of donors immune either as the result of vaccination or as the result of having recovered spontaneously from the disease, but so far there has not been a large enough amount of systematic work for conclusions to be drawn as to the actual value of this procedure. Morel, McClure and others have used the blood of

artificially immunized donors in typhoid, but on the basis of the small number of their cases it is hard to judge whether or not the improvement is due to this kind of blood.

There is no evidence that transfusion does any good in acute infection with pyogenic organisms. Possibly one could get some benefit if he could obtain as a donor a person who had recently recovered from an infection with the identical organism. Perhaps in the very fatal general infections with hemolytic streptococci it may be worth trying the blood of persons recently recovered from scarlet fever or erysipelas if such can be obtained.

In subacute streptococcus endocarditis transfusion is indicated as a supporting measure, and the temporary results are often brilliant. As we now know that some of the cases ultimately become bacteria-free, and show a certain tendency to spontaneous recovery, it seems possible that if we can by transfusion sufficiently prolong their lives we may increase their chance of spontaneous cure.

VI. TRANSFUSIONS FOR INTOXICATIONS

The most important recent development in this field has been opened up by Rous's method of preserving erythrocytes by the addition of dextrose. Burmeister has published the results of extensive experimental work on animals in which he shows that dogs can be resuscitated from otherwise fatal illuminating-gas intoxication by the use of red blood cells preserved from three to seventeen days, and he proposes the establishment of emergency stations where human erythrocytes can be obtained just as pulmotor stations are now being maintained for the saving of lives of human beings, victims of illuminating-gas asphyxiation. It is well established that in these cases a preliminary phlebotomy ought to be done and all the experimental and clinical evidence points to the necessity of making both the phlebotomy and the transfusion large in amount, probably 1000 c.c. or over should be removed and transfused in each case. If blood is preserved for this purpose it should be obtained, as was pointed out above, from persons belonging to Group I (non-agglutinable red blood cells),

so that tests would be unnecessary in emergency cases. It is interesting to note incidentally in Burmeister's communication that one of his dogs died apparently from the results of intravascular agglutination (no preliminary tests were done). Ottenberg and Thalheimer have described similar experimental results in animals.

VII. TRANSFUSIONS FOR DEBILITATED CONDITIONS

It is probable that transfusion should be used more often than it has been in some wasting diseases such as tuberculosis and simple anemias and undernourished states. Now that the technic has been so much simplified we can expect to see it used much more readily in these conditions. In marasmus, however, our relatively limited experience with it has been rather disappointing, but even in these cases we believe that the repeated use of transfusion probably should be of great value in tiding infants over critical periods until the dietetic disturbance can be corrected.

Contra-indications to Transfusion. There are very few actual contra-indications to transfusion, but we believe that there are still many transfusions done which are not indicated, and we would discourage the custom of transfusing any patient who is apparently about to die because the family solicits such a transfusion. A considerable number of such unnecessary transfusions done, probably with a vague hope that somehow they might do good, but without any clear understanding of the indications, has unfortunately led the general public to regard transfusion as a procedure that is too often followed by death.

There is possibly one contra-indication, although we are not yet prepared to state this definitely—namely, the existence of a pneumonia or of congestion of the lungs. We are led to suggest this particularly because of the almost fatal febrile reaction which followed a transfusion for anemia in a child suffering from acute pneumonia. This was referred to above in the discussion of the citrate method of transfusion. In this instance the temperature rose to 107° F. and was followed by a critical drop and the patient recovered.

DISCUSSION

Dr. George M. Dorrance: I have only the greatest admiration for the presentations of Dr. Libman and Dr. Ottenberg. I am sure that any of us who have seen cases absolutely blanched and apparently dying, and then again half an hour after transfusion, would be willing to take that risk of 2 or 4 per cent. We know such cases would not otherwise have recovered. In Philadelpha our indications for the operation are not quite so broad as obtain in New York. There is one which we use here possibly a little more than is used in New York, the lengthened coagulability time of the blood. Personally I would rather use the Kempton-Brown method, but the citrate method is so easy I am sure that one can use it in any emergency and it is rapidly supplanting all other methods. In postpartum hemorrhage the doctor does not have time to have his laboratory tests made, and he takes his chances with hemolysis in those few cases in which it occurs. In cases of gas and other poisoning I have removed a certain amount of blood before transfusion.

Dr. Ottenberg (closing): I am rather glad there has been some criticism of transfusion. I think, however, that the procedure hardly needs a defence. There are a few conditions in which transfusion is definitely curative and entirely indicated, for example in gas poisoning and acute anemia from hemorrhage. It has been shown that salt solution stays in the circulation only for a short time, while the blood, if hemorrhage does not come on, stays there; the red cells stay there. Furthermore, if you bleed an animal until it is very anemic, then fill it up with salt solution, it still lacks red cells to carry out the function of the tissues.

Dr. Libman (closing): I am a laboratory worker; I pay no attention to theory when I see results. I think the method is a life-saving procedure so often that one should be very cautious in abandoning it. I would not go on record as opposed to the use of the citrate; it may be of just as much use as the other methods. I simply said the matter was one of personal feeling. Perhaps one is not justified in being governed by personal feelings. The citrate method is so much simpler and can be used, as Dr. Dorrance has said, by the house surgeon. I have indicated instances in which I thought it might be a little bit risky. We have not had accidents when we have waited for the results of tests.

THE ANCIENT FACTORS IN THE RELATIONS BETWEEN THE BLOOD PLASMA AND THE KIDNEYS[1]

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The animal organism, except that of the unicellular type, is a congerie of organs whose history, individually considered, as it is thus far revealed, constitutes the sciences we call comparative embryology and comparative physiology and which we must know, not only to comprehend the full significance of the work they now perform, but also to recognize and interpret the possible variants from the normal in function and structure which they may manifest. This history, in invertebrates as in vertebrates, is one of change either in structure or in function, or, often, in both structure and function, and, accordingly, frequently confusing and difficult to follow in any attempt to gain a full comprehension of the conditions and forces that determined the character of each organ.

One needs but to scan the list of the organs of the vertebrate body to illustrate how true this is. The nervous system with its protean manifestations in the line of evolution, the thyroid, the thymus, the suprarenals, the pituitary body, the pineal gland, the gills, the lungs, the alimentary canal with its accessory structures and even the liver, all have a past in which the dominant feature has been changed in structure and function with the result that the final stage in each transcends the earlier ones and so obscures their characters that it is now difficult to determine the earlier history except in some cases from the structural side.

One thing is indeed certain. The change has never been of the *per saltum* type. But it has been unceasing, without pause, and it

[1] Read April 10, 1917.

is progressing today as it has been in the long past. The Heracleitan flux therefore plays its part in organogenic evolution as distinctly as it does in the physical world.

Among all the organs with their varied history as to structure and their variations in function, there is, however, one whose function in one particular respect has not changed from the time when it first began to evolve in the very far past. This organ is the kidney and the function which it performs, as it has performed it far back in the very beginning of the history of vertebrate life, is the regulation of the inorganic composition of the internal medium of the body, which we know as the blood plasma.

This organ was among the very first to appear in the protovertebrate, or in the first invertebrate type which began to differentiate along the line of development which resulted in the appearance of the protovertebrate in the Cambrian, or it may be pre-Cambrian times. If we may rely on the order in which the organs appear in the embryological history of the vertebrate, the renal organ is as ancient as the neural canal, and its origin would appear to antedate by a long period the closure of this canal and the disappearance of the celomic cavity into which the primitive nephric tubules opened. If the latter are, as has been claimed, derived by differentiation from the coxal glands of a crustacean-like form, they are of more ancient origin than the neural canal itself.

What the kidney of the protovertebrate was we may gather from the earliest form of the vertebrate kidney, which consisted of three divisions, arranged in order from before backward: the pronephros, the mesonephros and the metanephros. One of these, the mesonephros, becomes the adult kidney in fishes and amphibia; another, the metanephros, becomes the functional kidney in other vertebrate classes, reptiles, birds and mammals. This is of significance, as I shall show later, in indicating that the regulation of the inorganic composition of the blood plasma exercised by the adult kidney must have been exercised also by the kidney of the protovertebrate.

In order to understand what this regulation involves we must for a moment consider what the inorganic composition of the blood

plasma is. The salts of the blood plasma in amount range between 0.78 and 0.88 per cent. of the weight of the plasma, and they consist of the chlorides, phosphates, carbonates and sulphates of sodium, potassium, calcium and magnesium. The salts of sodium are by far the most abundant, after which come those of potassium, calcium and magnesium in the order mentioned. The salts of sodium, chiefly the chloride, amount to more than 90 per cent. of the total inorganic solids of the plasma.

The composition in detail has been determined by Bunge for the horse, ox and pig, and by Abderhalden for the ox, horse, pig, sheep, dog, cat.

The composition of human plasma has not hitherto been determined since 1850, when Carl Schmidt published the results of a number of analyses which are quoted now in all the text-books. They were obtained by the methods in use seventy to eighty years ago, which gave less exact determinations than do those now followed in making such analyses, and, consequently, the percentages, notably those of potassium, calcium, magnesium and chlorine, which Schmidt's determinations yield, are open to question.

The inorganic composition of the plasma in birds, reptiles and amphibia has not been ascertained, but the total percentage of the ash has been found to range between 0.8 and 0.9 in birds and reptiles, while in the frog it has been estimated to be as low as 0.46, but this may possibly be due to the difficulty of getting enough of the plasma of the frog free from admixture with water or lymph. The fact that in birds and reptiles the percentage of the salts is as high as in mammals is an indication that the details of the composition are not widely different from those of the plasma of the mammals above mentioned.

The analyses of the blood plasma in fishes which we have today are only those of the cod, pollock and dogfish, which I made eight years ago, and they are of special interest in connection with the analyses of the blood plasma of mammals.

If one examines Bunge's and Abderhalden's tables, giving their analyses, one is impressed only with the fact that the details obtrude themselves to the exclusion of all else, that in fact one does not

see the woods for the trees, and, in consequence, the significance of the results may be obscured.

If, however, one selects the cationic elements and arranges them in values proportional to the most abundant one, sodium, which may be made equal to 100, order is obtained from the maze of details in these analyses, and one finds surprising resemblances in the values obtained from plasmas of all the mammals. Further, the proportions obtained from the analyses of the plasma of the fishes referred to fall into line with those of mammals in such a way as to suggest that we have thus revealed a cardinal feature in the inorganic composition of the blood plasma of vertebrates.

This feature is indicated in the following table of ratios in which Na = 100:

	Na.	K.	Ca.	Mg.
Dogfish (*Acanthias vulgaris*)	100	4.61	2.71	2.46
Cod (*Gadus callarias*) . .	100	9.506	3.93	1.41
Pollock (*Pollachius virens*) .	100	4.33	3.10	1.46
Dog	100	6.86	2.52	0.81
Mammal (average) . . .	100	6.69	2.58	0.80
Man (per C. Schmidt) . .	100	9.22	3.37	1.76
Man (per Macallum) . .	100	6.11	2.71	0.85

The ratios for man are derived from Schmidt's analyses, the data from which, as already stated, are accepted with reserve, more especially as in my own determinations on the blood plasma of man the values for potassium, calcium and magnesium are much lower than those given by Schmidt and in general accord with those of Abderhalden and Bunge for mammals.

The ratio of potassium in the blood plasma of the cod is high as determined in my own analyses, but this may possibly be due to hemolysis, the preparation of serum which I used having a reddish tinge and therefore probably contained the potassium of the hemolyzed corpuscles, which thus would give a higher ratio for this element than would be given by pure plasma or serum. The fact that so near a relative of the cod, as is the pollock, gives less than half the ratio of the cod and approaches very closely that of the dogfish supports the view that the ratio in the cod is less than that given above.

Apart from these exceptions, if they are to be ranked as such and not due to errors in analysis or to abnormal composition, the striking feature is the very extraordinary parallelism between the ratios in mammals and those in fishes. This parallelism appears enhanced when one considers that the concentrations of inorganic salts in both classes of vertebrates differ. The concentration in the serum of the mammal, as already stated, ranges from 0.78 to 0.88 per cent., in the sera of the cod and pollock it is 1.282 and 1.293, respectively, while in the dogfish it is 1.774, or practically, double what it is in the serum of a mammal.

The parallelism in the ratios of the individual elements in the highest as well as in the lowest vertebrates is a cardinal fact, something more fundamental than the total concentration of the salts in the plasma. Its occurrence in two such widely separated classes of vertebrates suggests that it is an endowment received from the common ancestor of both, the protovertebrate, which must have existed in the early Cambrian or pre-Cambrian times.

What is the explanation of these ratios between the sodium, potassium, calcium, and magnesium?

The answer to this question I obtained some fourteen years ago when determining the inorganic composition of certain medusæ and comparing it with the composition of the ocean water of their habitat. *Aurelia flavidula*, the common jelly fish of our coasts in July and August, when it is liquefied, which happens when it is allowed to stand in a dry dish, furnishes a liquid in which, besides organic constituents, is contained a concentration of inorganic salts like that of the ocean water from which the animal was taken. From the analyses of its salts, compared with those of ocean water, ratios between the sodium, potassium, calcium and magnesium (with Na = 100) were obtained which revealed a very striking parallel.

	Na.	K.	Ca.	Mg.
Ocean water (Dittmar) . .	100	3.63	3.91	12.10
Aurelia flavidula (Macallum)	100	5.18	4.13	11.43

The parallelism between the two series of ratios is very close and the conclusion follows that the fluid in the tissues of *Aurelia* is

but very slightly modified ocean water and of the same concentration as the latter.

It was, however, when the ratios for sea water were compared with the ratios for the blood plasma of a mammal, for example, the dog, that one obtained a clue to the origin of the ratios in the blood plasma of vertebrates. We see in the latter that the ratios are parallel to those of ocean water:

	Na.	K.	Ca.	Mg
Ocean water (Dittmar) . . .	100	3.61	3.91	12.10
Aurelia flavidula (Macallum) .	100	5.18	4.13	11.43
Dog (Abderhalden)	100	6.86	2.52	0.81

except in regard to magnesium. Were the ratio of the latter in sea water reduced to 1, or thereabouts, the parallelism between the two series would be so striking as to render unnecessary further discussion of the question of the origin of the ratios in the blood plasma.

That these ratios are of oceanic origin can admit of no doubt when we look further into the matter.

The horseshoe crab, *Limulus polyphemus*, which has had its habitat in the ocean since the origin of the genus to which it belongs, in the early portion of the Palæozoic age, has a plasma in which the parallelism between it and ocean water is incontrovertible. This is, undoubtedly, due to the fact that the osmotic pressure of the ocean has been acting on the plasma of this animal and its ancestral forms through the many millions of years which have elapsed since the Cambrian age, and, though the ocean has been undergoing, in all that time, changes, not only in concentration, but also in the ratios of its cationic elements, the blood plasma of this form has kept pace with it, and today the concentration of the salts in the plasma equals that of the ocean water and the ratios of the cationic elements of the salts in the plasma are practically those of ocean water. We see thus that the ocean water does in this case determine the inorganic composition of the blood plasma.

	Na.	K.	Ca.	Mg.
Ocean water (Dittmar) . . .	100	3.61	3.91	12.10
Limulus polyphemus (Macallum) .	100	5.62	4.06	11.20
Homarus americanus (Macallum)	100	3.73	4.85	1.72

In the plasma of the lobster, *Homarus americanus*, the ancestral forms of which have been associated with the ocean only since the Cretaceous period, the concentration of the inorganic salts is as high as that of the ocean water of its habitat, and the ratios of the cationic elements are the same except for magnesium, which is about one-seventh that of ocean water.

In both the lobster and the horseshoe crab the concentration of the inorganic salts of the plasma appears to vary with the concentration of the ocean water of their habitat, and in brackish water it falls to that of the latter. The concentration of the salts of the plasma in these forms follows the concentration of the medium, whereas in the Selachians, which include the sharks and the dogfish and which have had their habitat in the ocean ever since the early part of the Palæozoic age, the concentration of the plasma salts exceeds half that of ocean water to a slight extent, although the osmotic pressure of the ocean has been exerting its effect on the Selachian plasma for at least several scores of millions of years. In the marine Teleostean fishes, which, like the cod, have been denizens of the ocean for a time, perhaps, not half as long, the concentration in the plasma is but little more than a third of the concentration of the salts in the ocean.

In the marine invertebrates of today the circulatory fluid is but a more or less modified form of sea water. In some the circulatory channels freely communicate with the exterior with the result that the circulatory fluid is pure sea water, but, even when the circulation is closed as it is in the horseshoe crab, the blood plasma is sea water with proteins and other organic constituents.

There is then a profound difference between the blood plasma of vertebrates and that of invertebrates. That of the latter varies more or less readily with an immediate change in the medium of the habitat, while that of the former is affected, and then but appreciably, only after millions of years.

Are we then to conclude that the plasma of vertebrates was originally of origin different from that of invertebrates?

If we scan the tables of ratios for the sodium, potassium, calcium and magnesium in the plasmas of the different forms of vertebrates

and invertebrates, we see in the parallelism already referred to an unmistakable indication that the blood plasma of vertebrates was also originally sea water, not indeed the sea water of the present age, but of a far past when the concentration of its salts was less than one-third of what it is now and when also the potassium was relatively more and the magnesium relatively less abundant than in the ocean of today.

The sea is the original home of all life on our globe, and it was in the sea that the differentiation between animal and vegetable life as well as the evolution of the great divisions of the animal kingdom were effected. Indeed, the great events in the evolution of animal forms have been rendered possible by changes which have taken place in the composition of the ocean. Among the fundamental results of these changes was the development of a closed circulatory system of vertebrates, the fluid contained in which became henceforth independent of the composition of the contemporary ocean, and, as we have seen, of the ocean of subsequent periods even after many millions of years, as in the case of the Selachians (sharks), marine Teleosts (cod, herring) and the Cetacea (whales).

The sea ever since the first condensation of water on the original cooled rock crust of our globe has been changing in composition by the leaching out of its bed the salts it contained and by receiving salts in the river discharge, also leached from the land areas of the globe. The quantity of salts annually discharged from the land areas is enormous and it is estimated by Sir John Murray at about one hundred and fifty-seven millions of tons (157,270,000), which, if divided into the amount of salts which he calculates as contained in the ocean today, namely, 14,151,000,000,000,000 tons, would, as Joly points out, give the age of the ocean as approximately 90,000,000 years. The concentration has therefore been slowly changing and it must have been in the far past much less than it is now.

The relative proportions of the various salts must have changed also. All the salts discharged in the ocean by the rivers have not been retained, for, were they retained, the potassium and the

calcium salts would be very greatly more abundant than they are now. Indeed the calcium salts in the ocean would have long ago reached a degree of high supersaturation quite impossible to conceive of, for all the calcium salts from which the limestone strata of the earth's crust were derived by deposition from sea water in the past ages, would thus be held in solution in the sea. The potassium was, once, relatively to the sodium, more abundant than the present ratio indicates, and it has been and is being constantly extracted from the ocean in the formation of such minerals as *glauconite* apparently at a rate which keeps its concentration over long ages fairly constant. The magnesium salts also have been concentrating slowly, for the elimination of magnesium as carbonate in the formation of dolomitic limestone has been proceeding at a rate less than that of the constant addition through the river water. This would postulate that magnesium is not only absolutely but also relatively more abundant in the ocean of today than it was in that of the far past.

The only constituents that are not extracted from the ocean are the sodium salts. These have always therefore been on the increase from a time in the early pre-Cambrian age when they were perhaps but slightly in excess of those of potassium. Their increase will proceed in the ages to come and finally produce such a degree of concentration and, consequently, such a specific density that will, as in the water of the Dead Sea, permit the human body to float because of its relatively lower specific gravity.

The differences in the series of ratios exhibited by the sodium, potassium, calcium and magnesium in the blood plasma of vertebrates on the one hand and in the sea water of today, on the other, parallel as these two series so strikingly are, can be explained as due to the blood plasma reproducing, approximately, the ratios obtaining in the ocean of the time when the original ancestral form of vertebrates, the protovertebrate, or eovertebrates, arose. The total concentration of the salts in the blood plasma can also be explained as due to a reproduction of the concentration of the sea water of the same age, that is, when it had less than 1 per cent. of salts.

How far back in geological time this period was it is difficult to determine exactly. It must have been earlier than the earliest or most ancient fossil remains of vertebrates indicate, that is, in the earlier Cambrian or even pre-Cambrian age, for the protovertebrate must have long preceded the vertebrates to which, through evolution, it gave origin. How long the intervening period has been is also difficult of determination. Estimates made on various bases give different results and the only satisfaction that one obtains from them is the recognition of their extreme limits, the maximal and minimal. Prof. Strutt in determining the content in helium of a mineral derived from Cambrian rocks of Renfrew County, Ontario, Canada, calculates that it was over seven hundred million years old. If, on the other hand, one follows Joly's method, based on the amount of salts in annual river discharge into the ocean, and the amount now in the ocean, and also accepting as approximately correct the percentage of salts in the ocean when the protovertebrate arose as less than 1 per cent., and therefore less than one-third of the concentration in the ocean of today, it follows that more than sixty millions of years must have elapsed since the protovertebrate appeared and disappeared on the geological horizon.

Whether we accept the higher or the lower estimate, or even a lower one still, the enormously long period during which the blood plasma has been simulating Palæo-oceanic conditions in the concentration of its salts and in the ratios of the sodium, potassium, calcium and magnesium it contains, emphasizes the importance in one respect of the organ which has maintained through the long ages of vertebrate history this concentration and these ratios, practically unchanged.

This organ is the kidney. There is in invertebrates no structure with a similar function or with a function even distantly approaching that of the vertebrate kidney. It is this organ that has made a fundamental difference between the vertebrate and the invertebrate, not only in the struggle for existence but also in the capacity to evolve higher forms of animal life. The animal form that must accommodate its internal medium to that of its habitat has an enormous handicap when it changes its environment, from ocean

to fresh water or to land, as compared with one whose internal medium, under all circumstances, is constant in composition. With such a handicap vertebrate life and all that it involves would have been impossible.

This function of the kidney is fundamental and is more ancient than that of excreting the waste products of the tissues of the body. In the dogfish, as in Salachians generally, whose history has been associated with the ocean since their origin in the Silurian period and in whose blood plasma the concentration of salts has in consequence been increased to only about half that of the sea, the difference between the osmotic pressure of the ocean water and that given by the salts of the blood plasma is equalized by urea which amounts to more than 2 per cent., and by ammonium salts, the concentration of which exceeds $\frac{N}{10}$ reckoned as NH_3. This retention of urea and ammonium salts undoubtedly developed as a result of the tendency of the blood to balance the slowly increasing osmotic pressure of the sea water. The very fact that the kidneys in these forms exhibit inertness in the elimination of urea while they are extremely active in the elimination of salts is extremely significant. What they do most rigorously is the regulation of the inorganic composition of the blood, therefore the more firmly fixed physiological habit must be the more ancient one and, consequently, their earliest function was not the elimination of waste metabolic products but the regulation of the inorganic composition of the blood plasma. The function of excreting waste products developed later but in the Selachians never acquired the fixity that characterizes the other function.

The fact that the kidney of the mammal, derived as it is from the metanephros division of the kidney of the protovertebrate and the kidney of the Selachian, which is developed from the mesonephros division of the same, have this fixity of function in the excretion of salts indicates, unmistakably, that the kidney of the protovertebrate had acquired this fixity.

In the long ages the kidney has thus performed a function which, for constancy and unvarying regularity, is unrivalled in the world of life. This constancy contrasts strikingly with the variations in

function which the other organs have undergone and it indicates how basic the kidney is in the vertebrate system and why it takes precedence in the body as a vertebrate organ *par excellence*.

How it happened that the kidney in the protovertebrate acquired this fixity of function we do not know. Geologists concede a very long time to the pre-Cambrian age, a duration which, according to different estimates, ranged from one-third to nine-tenths of the whole geological period. In this long cycle of time many things could have happened and conditions must have obtained which impressed on the primitive kidney of the protovertebrate an abiding character, not to disappear even though the original organ underwent a marked transformation in structure before it developed into the renal organ of the vertebrate of today.

The question now arises, whether this Palæo-oceanic character is ever disturbed in disease of the kidney and, if it is, what are the results.

To this question there is not much to offer in the form of an answer. There have been very few investigations of the inorganic composition of the blood plasma in disease, and these only of a very limited scope, bearing almost wholly on the chlorine content, the amount of which was supposed to give an indication of the total concentration and of the sodium present. The conclusions based on such analyses are, of course, accepted only with reserve simply because of the tenuity of the data on which they are based.

Believing that the subject had possibilities in a clinical line, I undertook during the last five years investigations on the inorganic composition of normal human plasma, with a view to comparison of the same with the blood plasma in cases of Bright's disease, and, more especially, in cases of puerperal eclampsia. These investigations are not yet completed, owing to the time-devouring character of the work involved, but some of the results so far obtained are definite and interesting and they may be mentioned here.

The determination of the inorganic composition of normal human plasma has given data which place it in this respect in line with the plasma of the average mammal, a result which could not be obtained with the data furnished by Schmidt's analyses. That the

difference between the two is important may be seen by comparison. In Schmidt's determinations the value of the sodium ranges from 0.3173 to 0.3438 per cent., and that for potassium ranges from 0.0314 to 0.0332, while in my determinations the value for sodium ranges from 0.29 to 0.316 and for potassium from 0.019 to 0.0212. Schmidt's values for sodium are nearly 10 per cent. higher than mine, while those for potassium are about 60 per cent. in excess of the values which I obtained. The differences are important enough to be emphasized.

The results obtained for the plasma in Bright's disease are quite incomplete but those for puerperal eclampsia are far enough advanced to enable me to give some points of interest.

In 4 cases the ratios on the bases of Na = 100 were:

Cases.	Na.	K.	Ca.	Mg.
1	100	17.66	4.02	3.42
2	100	26.70	3.27	2.37
3	100	10.60		
4	100	10.10	2.59	0.68
[5 (normal)	100	6.11	2.71	0.85]

The magnesium and calcium content is high in Cases 1 and 2 and normal in No. 4, but in all the potassium is in excess and in No. 2 extraordinarily so, as much as four times the normal, while in No. 1 it is nearly three times the normal.

There was a minute quantity of hemoglobin in the serum of all the four cases, as revealed by the spectroscope, and some of the potassium found in excess of the normal may have been derived from hemolyzed red corpuscles which are rich in potassium salts, but this would not explain the excess in No. 2, in which the amount of hemoglobin in the serum did not exceed that in Nos. 3 and 4. It is possible that hemolysis in the circulating blood may be responsible ultimately for this excess, but this does not explain the non-elimination of the potassium in excess above normal by the kidneys. Temporarily, at least, in eclampsia the cellular elements of the kidney concerned in maintaining the normal ratio of potassium in the blood plasma must suffer a partial or total eclipse of function.

I am inclined to infer from the results of my observations that the very first change from the normal to the definitely established

primary condition in some of the forms of Bright's disease is a loss of the power to maintain the Palæo-oceanic ratios.

The structures in the kidney involved in maintaining these ratios are the proximal convoluted tubules, which, with the glomeruli, are derived from and therefore represent the original parts of the kidney of the earliest vertebrates and of the protovertebrates. The proximal convoluted tubules are also concerned in reducing the H-ion concentration of the blood, for they secrete acid, not acid salts, into the urine, a function which is also very ancient, a function performed in invertebrates by all the cells of the body situated near the body surface, and still performed intermittently and with a high degree of specialization by the gastric glands of vertebrates. In some invertebrates other tissues have specialized in this matter also, as for example, in the salivary glands of the carnivorous mollusc, *Dolium galea*, the concentration of the sulphuric acid of the "saliva" of which exceeds 4 per cent.

It may be that the function of preventing the ever-tending-to-increase H-ion concentration of the blood plasma is as ancient as the Palæo-oceanic function, a view which their common localization in the proximal tubules supports.

Enough has been said here to emphasize the view that behind the functions of the renal organ is a history which links up the human body with the far past with an age of the earth when its oceans contained only what would now be regarded as brackish water and the earliest type of vertebrate life was just beginning to appear as a marine form. From the facts advanced it will be gathered also that the blood plasma, so far as its inorganic salts are concerned, is but a reproduction of the remotely ancient ocean, and that it is an heirloom from the life in

> "that immortal sea
> Which brought us thither,"

not indeed in the Wordsworthian sense, but in the literal one, for the sea is the original home of all life on the globe and gave our blood, and, accordingly, the tissues of our bodies, a character that long ages have not effaced and will not efface.

MUNICIPAL STREET CLEANING[1]

THE following named invited guests and Fellows (Mr. Featherstone, of New York; Mr. William H. Connell, of Philadelphia, and Dr. A. C. Abbott, Dr. Wilmer Krusen, Dr. Henry D. Jump, Dr. Joseph S. Neff, Dr. Seneca Egbert, Dr. John W. West and Dr. Walter G. Elmer) took part in a discussion on municipal street cleaning:

MR. FEATHERSTONE: I find that street cleaning has not quite reached that stage at which it can be placed in a scientific category. Some time ago in discussing the matter with physicians in the New York Academy of Medicine I raised the question of what a clean street meant. I found there was very little agreement upon this question, mainly due to the fact that there has not been developed any standard by which we can measure clean streets. A clean street in a general sense depends upon the time and place and very often upon the condition of the person affected. We find in New York that to keep up with the times it is necessary to motorize the department equipment. I had the opportunity the year before the war of spending some time in Berlin. That was in my opinion the cleanest city I had ever visited. They were then starting to motorize their equipment, having motor-driven flushing machines to thoroughly cleanse the whole street surface one portion of the day, likewise cleaning the sidewalks, thus keeping the whole street surface in one standard condition. In most American cities the sidewalk is in the jurisdiction of the abutting property owners, the part between the curbs is cared for by the city and is usually a source of conflict between the property owner and the municipality.

The practical question confronting the man in charge of street cleaning work is that of securing satisfactory work at the least cost. In the matter of apparatus used the tendency is to replace horse-driven vehicles with motor. Street cleansing or flushing by water is the most practical system in universal use. During the winter the old-fashioned broom is to be relied upon. After all, even if you do motorize your equipment and adopt the most advanced type of machinery you still must have the man with the broom; he meets all conditions no matter what the character may be. In Chicago in the loop district they have developed what I consider to be one of the best plans of keeping the surface of the street clean in any

[1] Read June 6, 1917.

city of this country or abroad. There each night the whole street surface is thoroughly flushed by a motor-driven machine. During the day the street is thoroughly patrolled and the men use what is called the intensive method of cleaning the street. The men walk, and with a light pan and broom pick up the gross dirt, placing it in the receptacle along the side of the street. In this way the manure and other dirt are not ground into powder as is done with the sweeper.

The cleaning of the street affects to a greater degree the comfort of the people than we see. If it were possible for medical opinion to specifically fasten the causes of illness upon neglected street conditions I do not believe the municipalities of this country would fail to give street cleaning departments adequate appropriations.

We hear much of the street cleaning abroad. If the German street sweepers were transported to New York and required to do the same amount of work 8000 would be working upon 1500 miles; from London, 30,000. There is no reason why foreign cities should be cleaner than those of this country with such a discrepancy. Berlin's street cleaning costs $2,000,000 per annum, $1 per capita per annum. This is on a wage rate equal to about $1 per day. The German gets something over 4 marks per day. There is a discrepancy, therefore, not only in regard to the number of men but the cost is likewise very much greater.

Practically all cities suffer for lack of street order, particularly American cities. There is scarcely an American city in which there is not on the statute books official ordinances for the guidance of the people who use the streets. Any unlawful use of the street surface means additional abuse to the municipality. The man instead of doing the work he is engaged to do is busy in removing material unlawfully put in the street. This should be placed in the police department. It seems as though the police department were afraid to enforce minor ordinances. I know of no city in the country where these ordinances are enforced reasonably satisfactorily. In New York the citizens have taken hold of this movement for the purpose of having the authorities enforce the minor ordinances. Nobody likes the idea of being brought to court for dropping newspapers on the street. It seems rather absurb that such a thing should occur, but if the city is to look as it should and the street cleaning men have a chance to do their work you must enforce your ordinances.

There is an intimate connection between the street cleaning department and the household: (1) the street cleaning itself, and (2) the removal of waste. Removal of refuse vitally affects the household, in the matter of comfort, convenience, and to some extent the health. There is danger in the neglect of the garbage can. The object in the collection of refuse is its rapid removal and disposition at the least cost. Of the many ways of collecting refuse, the old horse must be depended upon to a great

extent, for if with an automobile truck time is allowed for the man to empty the cans not much is gained. We have in process in New York plans to motorize one district which is called the model district. We have taken every horse out. There are 250,000 people in the district. Sixteen motor-driven machines replace 120 horses. We use these machines for all three functions of the department—the cleaning of streets, removal of refuse and for snow work. The machines are designed to operate in two shifts for sixteen hours per day. In the early morning the refuse is collected; on the second trip ashes are removed, and on the third, rubbish. There are ten compartments in the vehicle which can be used for the reception of refuse, garbage and for the street cleaning purposes. It is possible to reduce the cost of cleaning and at the same time increase the quality of the work. A large water tank is attached to the machine. In the winter the machines can be used for the removal of snow. Upon the final disposition of refuse a great deal might be said. However, it is not a question which vitally affects the community, except in so far as the collection itself is concerned and the collection and disposal are intimately connected. The garbage is reduced to two products, grease and fertilizer base. New York has been able to get contractors to pay $120,000 a year for the contract of removing garbage and refuse, and has a contract for five years.

After all, finally resolved, the question of street cleaning is not so much a matter of method as it is of men; and not so much a matter of men as it is a matter of a man. First you must have the right to do the work, the legislative right or whatever right is necessary in order to place in the hands of an individual the power to do the thing he is employed to do. After you have given him that power it is "up to him" as an administrative official to produce results. Street cleaning is not an ordinary man's job; it is concerned in the matters of science, medicine, engineering, chemistry and administration. When the people demand that the streets must be clean they must place the right man on the job, pay him a good salary, and retain him during the time that he produces satisfactory results.

William H. Connell: As Mr. Featherstone has said, street cleaning has not yet been placed on a scientific basis. It is only within the past few years that engineers have had anything to do with planning or directing this work. In New York the first engineer who was placed in charge of street cleaning was Colonel Waring. He entirely reorganized the Department and methods and inaugurated a number of reforms, and has since been termed the "Father of Modern Street Cleaning."

Even today street cleaning is far from being entirely under engineering control. We still have political control in many of our municipalities and any ward politician is supposed to be eligible for the job of cleaning the streets according to the ward leader's view.

The street-cleaning problem divides itself into two main branches, the first of which is preventive and the second corrective street cleaning. Preventive street cleaning has entirely to do with the citizen's part and is governed by laws and ordinances relating to sweeping of the streets, overloaded wagons, improper, unsanitary and overloaded receptacles for ashes, rubbish and garbage and numerous other matters that are covered by laws and ordinances with a view of keeping all unnecessary litter off the streets. If these laws and ordinances were properly regulated the problem of cleaning the streets would be greatly lessened and the streets would be 50 per cent. cleaner. This result, however, cannot be entirely brought about through educational campaigns. There are always a number of people who will devote considerable time to such campaigns, and they pave the way for the enforcement of the law; in other words, the educational campaign must be backed up by the enforcement of the law. In most cities in this country these laws are enforced to a very much more marked degree than in Philadelphia. In fact, I do not know of any large city in the United States so lax in the enforcement of preventive measures relating to the street-cleaning problem as in Philadelphia.

With respect to the actual cleaning of the streets, the equipment and methods used in this city are as up-to-date as in any city in this country. The fault lies in the system under which the work is performed. This is the only city of the fifty largest cities in the United States where this work is performed by contract, and it is perfectly obvious that it is impossible to get results under this system where the contractor is exerting every effort to cut the work down as much as possible in order to swell the profits that can be obtained, whereas, were the work performed by Municipal forces the only thought of the foremen and men actually engaged in the work would be to do all the cleaning required of them during the hours they were working, as they would not gain any monetary advantage by knocking off a few hours or by stinting their work.

The question often arises as to just how far we should go with respect to expenditures for street cleaning. There is no question but that the streets can be made immaculate provided we are willing to pay the cost. The problem would therefore seem to resolve itself into the expenditure of sufficient money to clean the streets thoroughly enough to be entirely sanitary and to ensure comfort to those travelling over them in vehicles as well as pedestrians.

Today in Philadelphia the street cleaning specifications call for more cleaning to be done than ever before. This was necessitated by the increased traffic. In 1912 there were about 9000 automobiles using the streets; today there are more than 34,000. The traffic census figures show that there is from four to seven times the amount of traffic now that there was in 1912. This means that every particle of dust on the streets

in 1912 has become from four to seven times the nuisance today that it was then. This, however, should not excuse the lack of cleanliness of the streets. The Department should meet the new conditions.

The history of street cleaning in Philadelphia for the past few years should be of some interest to the members of the College of Physicians of Philadelphia.

The bids for street cleaning for 1912, which were received prior to the Blankenburg administration, amounted to $1,500,000. The specifications under which these bids were received, if enforced to the letter of the law, would have cost the contractors in the neighborhood of $4,000,000. The old system appeared to be, to have very stringent specifications and for the contractors to bid what they thought the City should appropriate for the work and then to do as much of the work as they felt they could do and at the same time retain for themselves a handsome profit. This method would also enable them to break any contractor who was not "in right."

During the Blankenburg administration the street-cleaning specifications were entirely revised, so that the respective bidders bid on known quantities, such as a specific number of block men, gang men, machine brooms, squeegees, flushers, etc. All uncertainties were eliminated from these specifications and it was only necessary to total up the number of men and the amount of equipment called for and multiply it by the price which it was verbally agreed upon should be paid for labor, and this with the profit added constituted the bid. The Department practically assumed the responsibility for cleaning the streets with the amount of equipment stipulated in the specifications, so that there was no risk whatever to the contractor.

The contract method of performing this work should be eliminated at the earliest possible moment. You might just as well attempt to repair country roads by the contract system as to clean the streets. There is no definite standard which can be established for each individual engaged to ensure the kind of work necessary to make the streets as clean as they should be. You may stipulate anything you please in the specifications, but in order to get 100 per cent. efficiency from the men behind the brooms they must have some sort of incentive. They do not have and never will have such an incentive as long as the contract system is in vogue. The contractor bids on the work for profit. Superintendents are charged with the duty of providing a certain number of men and machines and a certain amount of equipment on the streets. It is perfectly obvious that these superintendents will not take the pride in the work that they would if they were employed directly by the City. It is practically impossible under the contract system to get the men pushing the brooms to do any more than push these brooms just enough to keep from stumbling over them.

Since 1912 we have each year been calling for an additional amount of street cleaning, averaging about $150,000 a year, and the cleaning this year showed an increase of $500,000 over last year. The contract price for 1917 street cleaning is $2,002,900 and for collection of ashes, rubbish and garbage $1,141,890, or a total of $3,144,790. For this figure the work could be performed by Municipal forces and the streets would unquestionably be very much cleaner than they are today.

Since 1912 the street-cleaning specifications have been improved upon every year. One of these improvements consisted in increasing the amount of hose flushing each year. This is of course the most desirable method of cleaning the streets, but it is also by far the most expensive.

It is only within the last ten years that it has become a recognized fact that street cleaning is an engineering problem, and when this fact has been fully accepted by municipalities throughout the country and engineers placed in charge of the work we will have more definite standards to work to, and through engineering studies we will have more improved types of equipment, which will go a long way toward solving the street-cleaning problem.

I agree with one of the speakers that the people are getting just what they voted for. If they will insist upon the elimination of the contract system the streets will be clean.

A question has been raised relative to the use of the vacuum cleaner.

Vacuum cleaners of course can only be utilized in dry weather, and are quite extensively used in Los Angeles, where they have long dry spells. The only way vacuum cleaners could be utilized in this climate would be to have a combination vacuum cleaner and machine broom, so that in case of a shower during the day or in the early morning in certain seasons of the year when there is considerable moisture on the pavements the machine broom could be operated.

Dr. A. C. Abbott: When such experts as Mr. Featherstone and Mr. Connell cannot give us a definition of a clean street it is scarcely within my province to try. I will, however, say that anyone desiring to see *unclean* streets need only walk about Philadelphia with their eyes open. That the streets of this city are filthy admits of no debate. And though a committee on clean streets, representing three important organizations, has been vigorously at work trying to get an improvement of conditions, I, as a member of that committee, experience no feeling of optimism, as to the results; certainly not under the present state of affairs.

Mr. Featherstone referred at some length to the city of Berlin. The city of Berlin when I was there offered an impressive object lesson. There the department of street cleaning is controlled by a trained engineer ordered to keep the streets clean and held responsible for the results.

The question is not one of politics, it is merely that clean streets were desired; they know how to fix them and they got them. I lived for a winter in Berlin some years ago; I saw it snow off and on more or less hard for a little over a month and there was not as much snow on the sidewalks as you will see on the sidewalks of Philadelphia after every little snow flurry, of which we have many every winter. The snow was carted away as fast as it fell. At no time was the wheeled traffic impeded or the pedestrian inconvenienced.

Mr. Connell and Mr. Featherstone both speak of the coöperation which should exist between the individual and the authorities. That is all very fine. You can get coöperation between citizens and the authorities to a certain extent, but there are thousands in every city who have neither the intelligence nor the desire to coöperate, and it is foolish to ask them. That defect should be, and doubtless is, kept in mind when the specifications for cleaning are written and the contract awarded. We have no police coöperation in Philadelphia with the street-cleaning department. We have not enough police to do correctly the ordinary police duties, and it only makes things worse to put upon them the duties of a police sanitary corps. The policing of a city is costly, cleaning is costly, but no one would complain if we got satisfactory results for the money spent. When, however, we spend a million and a half or more annually and get such poor results as we do, I should say conditions are decidedly unsatisfactory. If we are not sufficiently taxed to do this work properly, let us be taxed more highly, but let us insist that the work be done as it should be. It is my belief that good results cannot be obtained under the present system. You all know who controls Philadelphia politically. You all know who holds the contracts. You all know who determines the appointments of district inspectors. Occasionally Philadelphia has shown that it is strong enough to free itself from such hampering influences, but the efforts are only spasmodic and have little or no effect in the way of permanent betterment.

Great emphasis was laid on the matter of *the* man; but you cannot get *the* man if he is to be hampered by political meddling. The only possible way to get that man is to give him full authority and hold him responsible. The responsibility must be where you can put your finger right on it.

As to the enforcement of the laws: The promiscuous distribution of circulars is illegal, and the police department knows it is illegal, yet the streets are littered with all sorts of advertisements and nothing is done to stop it. Another intolerable annoyance, if not an illegal one, is the obstruction of the streets during building operations. What could be more outrageous than the obstruction with materials and litter of a principal street as narrow as Walnut Street, between Broad and 15th Sts., as has

been done for two months or more. The heavy traffic, both wheeled and foot, are seriously and continuously inconvenienced by it. And dirt is everywhere in the neighborhood.

In the matter of flushing the streets, those streets that need it most do not get it.

I fear I have spoken much like a scold on this subject and I confess after weeks of work, with so little to show for it, I feel very much in a scolding humor.

Dr. Wilmer Krusen: The Health Department stands directly back of any movement to secure clean streets in Philadelphia. I am more inclined to discuss the discussion than to discuss the papers presented. In whatever spirit Dr. Abbott may have spoken, I know his heart is right and, as a member of the Board of Health, he speaks with authority on this matter. There is no question but that the matter in Philadelphia rests with the citizenship which elects its officials. We are trying in the Health Department to do all we possibly can to prevent a recurrence in Philadelphia of epidemics. Mr. Featherstone has said that if we could prove that certain diseases were due to dust that the public would then demand a clean city. There is enough evidence in the hands of bacteriologists to prove that many diseases may be transmitted by dust. I have taken the matter up with the chief of the new Bureau of Street Cleaning and he is cognizant of the fact that the medical profession is demanding clean streets in the city of Philadelphia.

Dr. Henry D. Jump: It is right inspiring to hear Dr. Krusen detail what the new Department of Street Cleaning has promised to do and exceedingly encouraging to have him back us, as he has always done in the past, in our movement to improve conditions. That he lays the stress upon moral suasion of the individual citizen and upon the city government corresponds with our idea of the right action to be taken. I have not felt from my experience in street cleaning work that scolding would accomplish very much, but that public sentiment and publicity through the newspapers might arouse a civic control of these matters. It makes little difference to us what the cost of clean streets may be in Berlin or in New York. We are asking that our streets be clean. It is to be deplored that out city officials do not enforce the ordinances taking care of the matter of clean streets. During the visit of the advertising men here last year we made a tremendous effort to be clean, and the center of the city was kept so clean that they left with the idea that Philadelphia was the cleanest city they were ever in. It is a pity they did not get down to Third and Carpenter and see some of the conditions there.

While Mr. Featherstone is right that we are unable to produce concrete

evidence that disease is caused by dirty streets, we have as a basic principle that dirt breeds disease. We also know that flies breed upon dirt and carry disease, also that the dust in the air irritates the respiratory tract and lessens resistance to the entrance of disease germs, thus producing disease. There is abundant evidence from such source that the streets should be clean. This cannot be accomplished by the present method of contract system. The matter is one of civic responsibility, the responsibility to be shared by the individual in doing his part in the general effort toward clean streets.

Dr. Joseph S. Neff: I have heard promises made for several years in regard to the street-cleaning problem; I have yet to see them kept. I do not look to the future with as much confidence as does Dr. Krusen, but I trust that the things expected of the new department may be carried out. I believe that the street-cleaning problem is dependent almost entirely —assuming that we have a proper head of the street-cleaning bureau— upon the police department. The individual policeman is not to blame. For example—we found after several years' effort, the policeman would not arrest the drivers of leaking garbage carts, for he was compelled to lose much time as a witness in court attendance and frequently was handled roughly by the defendant's lawyer and often time the trial officer. If the police should enforce the present laws he would have the unpleasant duty of arresting his own neighbors who might throw paper and sweep the dirt from the sidewalks into the street and then face a friendly magistrate who would discharge the guilty one, under orders of those higher up upon whom both magistrate and policeman were dependent for their position. As we have more square feet of sidewalk than of street; and the illegal custom of the housewife of sweeping the dirt of the pavements into the street continues, we will have just about as much dirt after the streets are cleaned as before.

Dr. Seneca Egbert: I think the population at large—and I am not desirous of belittling the people of Philadelphia—does not appreciate the importance of sanitary matters in general and of clean streets in particular. For five years I was president of the oldest improvement association in this city and one that has achieved some good results. My predecessor in office and myself had to deal with this problem of clean streets and the removal of waste. Our aim was to secure a proper removal of ashes and rubbish by private collectors and not to have the receptacles for the same placed on the curb, whence the wind would scatter the contents over the street and adjoining lawns. But it was and is difficult to secure a general compliance with the plan, and the carelessness or worse of but one householder in a block may make a very dirty street. It seems to me that not

only must we go to the city officials, the mayor, the contractor or the one in charge of the street-cleaning department, but we must appeal to the citizenship himself. We must make the people want clean streets before we can get them, no matter how zealous the man in office may be. As Dr. Abbott has said, popular education is at the root of the matter. When we have this education we shall be ready to vote the amount needed to bring the desired result. Therefore we might as well recognize the fact that we must take some of the blame upon ourselves and neighbors and not put it all upon our city officials. The contract system of cleaning streets, I believe, is wrong. We need to have one man responsible to the people and amenable to the law. That seems hardly the case in Philadelphia. When we all wake up and individually appreciate the importance of sanitation we shall get that which we desire.

Dr. John W. West: Philadelphia gets just as clean streets as she deserves. I think that is absolutely true. She is getting just as good government as she deserves. She will get what she asks for and what she says she must have. I am very thankful that I am an optimist, not a pessimist, that I am hopeful. There has been a good deal of study by the medical profession and allied agencies on the street-cleaning problem and this has brought results. Our streets are cleaner than they were six months ago; they probably will be cleaner a year hence than now, but this will not be obtained by scolding anybody. We will not get them as clean as they ought to be under any system of contract-controlled government. It depends upon the people to see that we have clean streets, to see that we have good government. The whole question of street cleaning must be studied as a scientific engineering problem. Only when this is done and the people stand back of such a movement shall we have streets that are pleasant to look upon and to live within.

Dr. Walter G. Elmer: The principal problem in street cleaning is the dust. It is raised in clouds by the rapidly moving motor cars and by the street sweepers themselves whenever the street surface is dry. We cannot say exactly how long the colon bacillus remains alive after it is exposed to the air and sunlight, but there can be no doubt that we breathe millions of these organisms into our air passages and lungs.

No mention has been made by any of the speakers of the use of vacuum cleaners upon the streets. They are being used successfully in the South. It is a dustless method of street cleaning, it is efficient, and, as one machine does the work of many individual sweepers, it is economical.

Philadelphia is a very wealthy community, with an area of 129 square miles. It might well be worth while to have this method tried on a single square mile in order that a comparison with the older methods might be made.

THE PROBLEM OF DEALING WITH VENEREAL DISEASES IN GREAT BRITAIN[1]

By COLONEL T. H. GOODWIN, M.D.
OF THE BRITISH ARMY

For some years past the problem of venereal diseases and their serious effects on the British nation have been occupying the earnest attention of the medical profession in England.

The problem is one of magnitude and importance; it is difficult, except in the case of the Navy and Army, to obtain reliable statistics regarding these diseases; but the following estimates may, I think, be accepted as approximately correct:

The Royal Commission on Venereal Diseases estimated that in the larger towns in England at least 10 per cent. of the total number of inhabitants were infected with syphilis, while gonorrhea was even more prevalent. This would mean that in London alone there were 450,000 syphilitics.

Erb estimated that 12 per cent. of the population of Berlin was syphilitic, and that over 70 per cent. of the population had, at one time or other, contracted gonorrhea. Fournier estimated that 15 per cent. of the inhabitants of Paris were syphilitic.

As regards syphilis, Sir William Osler places this disease as third on the list of what he terms the "killing diseases," and so generally are the inroads of this disease manifested on every tissue of the body that Sir William graphically remarks that "a medical student who is thoroughly grounded in this disease and the affections to which it gives rise would have acquired a good knowledge of all branches of his profession."

[1] Read October 3, 1917.

The question naturally occurs to us as to why, when such diseases as typhus, typhoid, scarlet fever, epidemic diarrhea and others have been adequately grappled with by the Public Health Service (or Department of State Medicine), yet venereal diseases would appear to have pursued their ravages, if not unchecked, at least inadequately dealt with. The answer I think is simple. It is due to the mistaken policy of silence, the unwillingness to recognize the existence and importance of venereal disease, the national habit of, as regards these diseases, "hiding our head in the sand."

It was not until last year that the State made serious effort in England to control and combat these diseases.

As regards the Army, with which I have been intimately connected for nearly twenty-five years, in spite of the fact that the best methods of treatment are in vogue and that the incidence of the disease has been diminishing, we find that in 1912 the average number of men incapacitated, or "off the strength," was 593, which with an army of 107,000 men represented a loss of over 216,000 working days in the year a serious item.

I say that the incidence of the disease in the Army has been diminishing; this is the case, and is still continuing to be the case. The rate for the year 1913 was 5.3 per cent. per annum, whereas the rate for last year was 2.1 per cent. per annum; but we must not allow ourselves to be misled by these figures into the adoption of what might be too optimistic a view. We should bear in mind that while active service conditions prevail the subject of venereal disease can be more adequately dealt with than during times of peace.[1]

What have been the chief errors and shortcomings in the past which have acted as obstacles to progress as regards prevention of venereal diseases?

I think we may summarize them as follows:

1. The policy of silence and concealment and the consequent

[1] I think, however, that we are justified in believing that improved methods of educating the soldier on this matter, the provision of greater facilities as regards games and recreations in cantonments, and the decrease of alcoholism have had a very considerable effect in decreasing the incidence of venereal disease.

lamentable lack of education and diffusion of knowledge on the subject.

2. The inadequate facilities for diagnosis and treatment.

3. The absence of any provision for compulsory notification.

4. The neglect to prevent quacks from treating the disease.

5. The fact that the transmission of venereal disease to another person by a person who is knowingly infected, does not constitute a legal crime.

How are these factors now being dealt with?

1. *Education.* The National Council for combating venereal disease, inaugurated in November, 1914, while the Royal Commission was pursuing its investigations, has done and is doing much excellent work.

This Council, with Lord Sydenham as President, embraces many leaders of the medical profession and has also—and to this I would direct especial attention—representatives of the churches and of many women, social and philanthropic workers, in close coöperation. The aims of the Council are briefly as follows:

(*a*) Provision for education and enlightenment.

(*b*) Provision of greater facilities for treatment.

(*c*) Provision of increased opportunities for study of these diseases on the part of medical practitioners and students.

(*d*) Promotion of legislative, social and administrative reforms.

As regards the Army alone, up to June last year, over 600,000 soldiers had attended the lectures given with the approval of the Director-General, Army Medical Service, in military centers.

2. *Diagnosis and Treatment.* The facilities for these in the past have been grossly inadequate.

As regards early detection of venereal disease it is probable that in England it is only in the Navy and Army that really full advantage is taken of the more modern methods. As regard facilities for modern methods of treatment there has also been a lamentable lack of provision.

The policy of the Royal Commission has been that of rendering the best means, both of diagnosis and treatment, available, free of charge, to every venereal patient who is willing to take advantage

of them. The point of view taken is that venereal disease once acquired it is both the duty and the interest of the State to see that it is promptly cured.

Outlines of the Scheme. Facilities for *diagnosis* are organized, so far as possible, in connection with existing laboratories in universities and in general and county hospitals: To these laboratories material is sent for examination.

As regards *treatment.* Wards in general hospitals for indoor treatment are allocated to venereal patients.

For outdoor patients evening clinics are provided. The objection to the provision of special hospitals for these diseases lies in the resulting publicity.

The wards and clinics should be accessible to all medical men and medical students who are desirous of acquiring proficiency.

It is recommended that salvarsan should be provided gratuitously, under proper safeguards, to private practitioners for use among the poorer patients.

3. *Compulsory Notification.* Logically, compulsory notification and compulsory treatment would appear to be sound, but it is perhaps doubtful if they would be practicable measures.

Sir Malcolm Morris himself believes that under present conditions these measures are out of the question and that notification would deter patients from seeking proper treatment, and that the inclination of patients to place themselves in the hands of quacks would become more serious than ever.

Sir William Osler would welcome notification, but there are many others who, looking at the matter from the point of view of the individual patient, would regard his confidence as inviolable.

The conclusion of the Royal Commission was against compulsory notification.

Personally, I believe that with the advance of education and enlightenment and the recognition by the public of the gravity of the matter, notification will become compulsory, and I am strongly in favor of the adoption of such a measure myself.

4. *Suppression of Quackery.* The Commission emphatically recommends that all advertisements of remedies for venereal diseases should be prohibited.

The Commission was also in favor of the legal prohibition of treatment, by unqualified persons, of these diseases; but apparently there are some practical difficulties in securing the operation of such a law at present.

I am not versed in legal matters, but to my mind such prohibition would be an essential and most important measure, and my personal opinion is that unauthorized treatment of these diseases should constitute a penal offense.

I also think that it should be the duty of a medical man to acquaint the parents of any girl who contemplates marriage with a man whom he is treating for venereal disease, and that such communication should be recognized as privileged.

5. *The Wilful Communication of Venereal Diseases.* This should, in my humble opinion, constitute a legal crime. The proof of knowledge might be difficult, but the effect of such a legal measure could only, I think, tend toward the good of the community.

Gentlemen, time is limited and the above is simply a brief sketch of how the question stands—so far as I am aware—in England at the present day.

The present world-wide war is, so far as we can see at present, productive of nothing but evil; but it seems possible that, in the post-war future, benefits to the race may result.

The war is teaching us to regard life and death as less important matters than the future welfare of mankind, and if such matters as adequate control of venereal diseases, world-wide prohibition of alcohol, and an increasing instead of a decreasing birth-rate result it may possibly be found that the war, terrible as it is, was not without some good results.

DISCUSSION

Dr. Edward Martin: The venereal diseases are the commonest, the deadliest, the most crippling, and the most easily controlled of all the diseases with which we have to do. The reason they are not controlled is that

the people do not want them controlled. The reason they do not want them controlled is that their efficient repression implies a certain publicity in regard to man's derelictions which would be irksome to 20 per cent. of the community. If we mean to grip this question efficiently we must clearly recognize the single factor which makes the grip difficult. A man with gonorrhea or syphilis who evades, neglects, or refuses treatment has no more rights in so far as the community is concerned than a child with measles or mumps, and he is far more deadly. Unlike the other diseases, gonorrhea and syphilis can be prevented even after exposure in 90 per cent. of cases, and this with little expenditure of time or material. Moreover, even when the disease has developed, syphilis can be made noncontagious in a very few hours. Why, then, with all the means of control at hand do we not take hold of this problem and help the Army? Col. Goodwin, Col. Russell and Major Snow have all described the admirable system which the War Department has evolved. It will fail of its full purpose unless we help. All we say tonight will lead no further than we have gone in the last ten years unless we adopt an aggressive policy and push it to the logical application. What shall we do? We mean to have our health officials treat the man with gonorrhea or syphilis or both, who cannot be kept under medical control, with as little respect to his rights as they would treat one suffering from smallpox. Our State Committee will recommend to the Legislature that places be provided for the treatment of such patients. There is no reason why every hospital receiving State aid should not take these patients within their doors and keep them until they are no longer sources of danger, except that in institutions where girl babies are cared for gonorrhea must be excluded. There exists an organization in every State, a branch of the Council of National Defense. In every county of each State there is a committee which will take up this matter, and we hope before the war is over to have a law by which these diseases under rational restriction must be reported, and by which a person conveying these diseases, knowingly or otherwise, may be liable for criminal prosecution or damages. We hope to have such hospital provision that those afflicted with these diseases may be adequately treated and the community protected from the menace of contagion, as in the case of other contagious diseases.

Major E. H. Siter: When we realize that there is only one hospital in the city of Philadelphia where an individual with venereal disease may go and be treated I think we have a sufficient commentary upon the prevalence of the disease. Take the prostitute of the street. Nowhere can she be treated unless she can afford to pay a doctor, and, as a rule, what sort of a doctor will she pay? She will pay her money and she will not get

any treatment. Prostitution in this country is not acknowledged; people say it does not exist. It does exist very much, and I think that after peace is declared and all the men in the Army see how the disease has been properly treated, the prophylaxis instituted, the emphasis put upon it, and the ravages made in the ranks, the great etiological factor will be corrected. I do not think it is the professional prostitute who does the damage, but the casual prostitute hanging around the cantonment. The disease must be treated intensively. They cannot be properly treated unless they are in the hospital. They should be treated sufficiently to get them back into the fighting with the idea of curing them after the war is over.

Dr. Jay F. Schamberg: The presentation of the various speakers of the evening have emphasized the widespread prevalence of venereal diseases both in the civil population and in the Army. We are impressed with the importance of their treatment and the difficulties surrounding their control. It may not be known to those present that in June of this year, at Cincinnati, there was formed the American Society for the Control of Syphilis. The membership is composed of specialists in various cities, who will develop the activities of the society along medical, legislative, and educational lines, at the same time coöperating so far as possible with the American Society of Social Hygiene. As Col. Russell has said, we should sterilize the sources of infection of venereal diseases; we must get hold of the carriers. This is a matter of prime and essential importance. Since the recent activity of the municipal authorities in cleaning up the southern part of the city, adjacent to League Island, we have had brought to the Polyclinic a greatly increased number of cases of syphilis, chiefly young women arrested on the streets and placed under the control of the Court Aid Society. We are giving fifty salvarsan injections a week; the patients come regularly, for there is no charge made for drug or service. A matter of great importance in the control of syphilis is the availability of salvarsan at a price which will permit its use by hospitals on a large scale on indigent ambulatory cases. Until recently a dose of salvarsan has cost $4.50 an ampoule. The cost is too great to permit the use of so expensive a medicament in adequate quantity upon all the indigent sick who require it. It has been impossible for those who have made salvarsan or its equivalent in this country to supply the drug directly to the profession by reason of the operation of the patent laws. The Adamson Bill, which has just passed both Houses, authorizes the President to license American citizens to prepare and market products patented by alien enemies, and provides for the payment of 5 per cent. of the gross receipts which shall be deposited in the United States Treasury until the end of the war.

The Dermatological Research Laboratories have made application for a license to distribute arsenobenzol. Over 125,000 doses of this drug have already been used in the United States. It is our purpose to progressively lower the price of the drug so that it shall be freely available for the treatment of the indigent sick. It is a matter of the greatest importance to hospitals, since they cannot use salvarsan adequately at the present market price. We propose, as soon as licensed, to place arsenobenzol on the market at $1.50 a tube to physicians, and to hospitals in larger sized ampoules at such a price that an individual dose may be administered for about eighty cents. The adequate use of salvarsan upon the ambulatory dispensary patients is of vital importance in the stamping out of contagious syphilis.

Dr. H. M. Christian: In view of the general trend of the papers read this evening it would seem scarcely appropriate to consider at any extent the ever-present and all-important subject of venereal diseases as they are found in civil life. Tonight we have had the matter brought to our notice in a most comprehensive manner as it affects directly the life and activities of the soldier. All the means being employed to divert the soldier's mind away from the venereal peril have been fully broached upon and emphasized. Most stress has been very properly laid upon the importance of removing at a far distance the potent factors for evil, the saloon and the camp followers.

At the same time there is in any community of from 25,000 to 30,000 young healthy men a condition to be reckoned with, which should not be ignored simply by burying our heads in the sand like ostriches and not recognizing it. A camp of soldiers is not any more inclined to immorality than the same number of men gathered together in one place in civil life would be. So far as this goes a well-known ecclesiastic has very recently said that "he would just as leave take his chances of salvation with the men in the camp as with those outside of the lines." A sentiment with which I think we are all in accord. Notwithstanding all that can be done for his amusement, the enlisted man away from home environments, lonely and dull, and subject to temptation will stray from the straight and narrow way. We cannot make him, any more than any other man, virtuous by statutory enactment or even through fear. The best and, to me, the proper thing to do is to safeguard him so far as possible from any remote results of his immorality. This brings up at once the question of prophylactic measures to be employed where the soldier has been exposed to the possible risk of venereal disease. I was rather disappointed that the speakers of the evening did not more fully dwell upon this matter. Prophylactic measures promptly and properly carried out undoubtedly from statistics published

also lessen in a marked degree the number of venereal cases, thereby preserving the efficency of the men and avoiding danger to their companions. In no sense could such procedure be considered as a compromise with evil. It is a condition which confronts us, and now, of all times, is the time to recognize it and deal with it in the most effective way that lies at our hand. I take it that it is not ours as doctors to discuss the morals of this question but to deal with it as an ever-present and persistent evil, if not to be wiped out entirely at least controlled and regulated by such methods as we can employ. Compulsory prophylactic treatment is to my mind the chief means of safeguarding any community, to say nothing of a soldier's camp.

Dr. Louis Jurist: The discussion has been largely upon the number of cases of disease found in the camps. It seems to me that this is up to the civil population, up to the community and State organizations, and is a question of the moral laws of the community, State and of the Nation. A good many years ago I read a very interesting book. I was a young man, and I remember it. One of the young fellows going to bed at night said to himself, in this book, "All men ought to marry at twenty-one!" I considered this from many phases. I did not know what the author meant. But it is the economic system that is wrong, and that is responsible for venereal disease in the community, in civil life as well as in military. I have not heard any percentages given per thousand in civil life and in military life. I have been most fortunate this summer in the opportunity of going to Allentown to serve on the Aviation Corps Board. The men have been of an especially fine class, mostly college boys, but whether or not from the college the standard of physical excellence has been very high. Not more than two weeks ago, however, I was told that there had been a case of syphilis in the hospital; how many there may be of gonorrhea I do not know. It is the duty of the civil authorities to clear up their places. I know, and am absolutely sure of what I am saying, that certain cities and communities near these camps should make it a business to clear up the situation, but they are not doing it. The greatest danger, it was told me by one of the men at Allentown, is from girls of fourteen and sixteen who are encountered at every turn. That, I think, is a matter for the civil authorities entirely to control and not for the military. The problem of overcoming syphilis and gonorrhea is not a legislative or preventive one, but may be made an economic question, which is the only solution next to education.

Dr. Paul A. Lewis: In a semi-official capacity I was called upon at the Pennsylvania Hospital to supervise the administration of salvarsan, and

in this connection I was able, with the help of a number of interested men, to get the managers to adopt a somewhat different attitude toward the treatment of syphilis than previously had been held. I have continuously been in an unofficial connection familiar with what has been going on, and have been advising the men doing the work. From the traditional attitude of the hospital managers that syphilis was not and could not be treated in the Pennsylvania Hospital, they have come to acknowledge the treatment of it as their duty. They do not, so far as I know, admit open syphilis to the hospital wards, but they do allow the use of the dispensary in a way which I regard as being very encouraging as things go. When we reached the stage at which they could with certain restrictions give salvarsan to those needing it, I was much influenced, by what had been accomplished in tuberculosis work, to see whether syphilis could not be similarly handled through the Social Worker as a respectable disease (so to speak), one which could be handled as a disease from every point of view, social, family, etc. For three or three and a half years now this clinic has been managed through a Social Worker, and it has been shown that the disease in many of its aspects can be successfully managed in that way. This Social Worker has been subjected to no disagreeable experience, and has handled all types of the disease. As time has gone on our practice has become in some measure a family practice. That is because the Pennsylvania Hospital does not in any of its departments handle a large number of acute cases of venereal disease.

Another aspect of the subject of special interest is that the expense in connection with salvarsan treatment is not as serious as hospital managers universally seem to regard it. To bring the matter up to date I may state the present situation: They are handling each week at the Pennsylvania Hospital about sixty patients. The standard price until the last week or ten days for a full dose has been $5, which yields a profit of about $2 in each case in which the $5 is paid. The Social Worker decides whether or not the patient can pay $5 or any amount. The hospital is making a profit which would enable it to actually pay for the service of the medical man in charge of the clinic and do a reasonable amount of charitable work. The prejudice in connection with the treatment of this disease is the prejudice of the educated classes. There is no prejudice among the class of people we are dealing with. Most of them do not know that it is an infectious disease. This prejudice will surely disappear under the enlightenment which the nation is about to get through its new Navy and Army and the guidance of such men as have spoken to us tonight.

Col. Goodwin (closing): There is one thing I should like to say. I do feel that I should like to put in a word for the soldier. I do not think

that the soldier is more immoral than the same class in civil life. There is possibly a certain amount of truth in the statement that we cannot make the soldier moral, but we can do an enormous amount to keep him away from the opportunity of getting venereal disease, and I think that the measure which has helped more than anything else in the Army to carry this out is the increased facilities for amusements. In all the camps and barracks the institution of the Y. M. C. A., with its recreation facilities, is one of the most important measures possible. Some few years ago I was doing duty at one of the largest cadet schools in England, and was told that the chief trouble among the young men was venereal disease, the Academy being within twelve miles of London. When I went there things were running very smoothly. I was there for four years, and the actual incidence of venereal disease was one case. These were young fellows of from seventeen to twenty-one.

Major Snow (closing): The subject has been expressed about as concretely as I have ever heard it by the speaker in the discussion who referred to the experience at the Pennsylvania Hospital. I was particularly struck with his statement that the prejudice concerning this matter is a prejudice of the educated class. I have been amazed at the apparent ease with which the whole machinery which we found so effective in dealing with the human carrier of tuberculosis could be adapted to this class of cases if we only go about it in the right manner. So far as the program to be carried out in dealing with these diseases is concerned, mentioned by Dr. Martin, I think it may be summed up, first, that it is the duty of the medical profession to see that provision is made for diagnosis, treatment, and follow-up service for every case we can detect, devising every measure we can for that purpose. The bulk of the cases are handled either by our dispensaries or by private practitioners; in other words, they come under the eye of the medical profession and a concerted effort is possible to treat the mass of carriers in civil life. Interesting experiments have been started of giving a patient instruction in his own case to prevent the spread of the disease. The second thing that the medical profession can do at all times is to turn its effort and its expression of opinion toward the education of public opinion to support a civil program in every community which is based upon the program now adopted and published by the United States Government. We have a parallel in the question of malaria. A doctor will treat all the malaria cases that come to him, but the public will never be rid of malaria by the treatment of the occasional case. The medical profession will be looked up to by the laity for the solution of this problem as in other communicable diseases. The first thing, therefore, the medical profession is to do is to provide for diagnosis, treatment, and follow-up

service; and, secondly, to educate the public that this is an epidemiological problem. There are here a few copies of the statement issued by the Surgeon-General of the program which the Army has adopted as a method of attacking venereal disease. These may be taken and others may be obtained on request.

Mr. George W. Braden: I simply want to emphasize the statement made before that moral standards maintained in a military camp greatly effect the venereal disease rate. A study of the Mexican border situation made by Dr. Max Exner, of the Y. M. C. A. International Committee and a member of the Fosdick Commission in training camp activities shows that where men were kept busy with wholesome games and amusements, proper educational service was rendered and temptation removed so far as possible in nearby towns. The number applying for prophylactic treatment was very low. Camp we will call I was of this type and their applicants were 0.0566. In Camp G, where conditions were favorable to low standard of conduct, the applications were 20 per cent.

AN INTERNIST'S VIEW ON ARMY MEDICAL SERVICE[1]

BY CHARLES FRANKLIN HOOVER, M.D.
CLEVELAND, OHIO

I SHALL speak of the medical service at the base hospital in which I spent some time and of the conditions about which we have seen a good deal in print.

I cannot say that there is a trench nephritis any more than an acute infectious nephritis from other sources. A streptococcic nephritis coming on in the trenches has no different characteristics than those cases developing in civil life. Of trench foot I saw very little, only 2 cases at the casualty clearing station in August, when the men were compelled to stand in the trench after a rainy period for three days without opportunity to put on dry socks. Curiously enough, trench feet vary greatly in appearance; one foot may be very pale while the other is rosy, showing very distinct vasomotor disturbance. Ultimately there are present the pathological conditions seen in obliterating thrombo-angeitis. This leads to gangrene and, of course, to amputation. Pathological examination of specimens shows the genuine thrombo-angeitis, but the early manifestations are purely vasomotor.

"Shell shock" has gained current use probably for no other reason than that it involves alliteration. If there were not the two "ss" used I think there would not be so much said about it. A man in the vicinity of exploding gunpowder may receive a number of injuries from the percussion wave, another may be hit by flying missiles, another man not hit may be thrown down and

[1] Read December 5, 1917.

later acquire aphasia. In such a man one is dealing with a functional disorder which is curable by persuasion. Of the medical officers recruited from the United Kingdom and Colonies not a large percentage would be able to differentiate between functional nervous disorders and a diagnosis of shell shock would naturally be given. In the British War Office if a man receives a bad casualty from which he develops shell shock he is given a very different standing from the man developing the condition when not subjected to such exposure. Very few of the latter are taken to the city hospitals and treated by neurologists, psychiatrists familiar with the handling of functional nervous disorders. Shell shock has quite disappeared from the experience of the medical officer at most of the bases.

Another subject I would mention is that of Basedow's disease. We have seen so much published to the effect that loss of sleep, violent shock to the system, physical exhaustion, all contributing to the group of symptoms which we term Basedow's disease. It is an interesting matter that I did not see but one case in which we were justified in entertaining even a suspicion of Basedow's disease. This was a young Canadian officer whom I had known before the outbreak of the war. He asked me to examine his heart, and I came to the conclusion that he was suffering from a mild Basedow's disease. Inquiring of a large number of British medical officers I could not find one who had seen a single case of Basedow's disease. If the disease have such an etiology as suggested by much that is written, certainly out of the great number of medical officers and the enormous number of patients we would have found at least an occasional case.

The two sorts of gas we met with were the chlorin and the blistering gas. The former penetrates the clothing, causing great bullæ to rise, the greatest edema being over points of the body where the skin is most delicate. The eyes were swollen tightly shut, giving the appearance of the men having been stung about the eyes. The bulbar conjunctivæ were also greatly swollen. There were no lesions of the cornea. None of the men had any impairment of vision, and all made good recoveries so far as the

eyes were concerned. There was enormous edema of the prepuce, which was a source of alarm among many of the men. The great bullæ would stand two inches above the surface of the body and were filled with plasma firmly coagulated. After the blisters healed there was left a tarry colored skin. None of the men attacked with the blistering gas had any injuries of the respiratory paths. From the total number of cases there were quite as many men suffering from blistering gas alone as from the phosgene. This was the most interesting subject which I had the opportunity of investigating. In the respiratory path, which has no sensory nerve supply, the damage is done without giving any warning to the patient. The men die instantly without evidence of respiratory distress. Such cases are not favorable to investigation. Were there sufficient pulmonary edema to cause death there would be some evidence of it. By the time the men came into the casualty clearing station we find they have a great amount of moisture in their bronchial tubes, coughing up large quantities of the plasma. (Explanation of this as given by Haldane shown on the blackboard.)

The lowering of the oxygen content of the blood produces the effect seen in the phosgene gas poisoning. In pulmonary edema the respiratory unit may be filled with balloons, each having a pellicle of plasma which the gas must penetrate to produce the effects seen. (Experiment explained on blackboard.)

If the men are given oxygen the color becomes normal in about five minutes. That which surprised me is the amplitude and rate of respiration. The pulmonary edema persisted, the oxygen only abrogating the cyanosis. The argument of Haldane is that it lowers the respiratory threshold. By the giving of oxygen we change the alveolar foam into oxygen foam. This greatly increases the area for the absorption of oxygen, but did not increase the evolution of CO_2. It, however, kept down the pressure, the patient having to breathe deeply and frequently. The signs of air hunger were not in the least modified by the giving of oxygen. The explanation of this is that while we modified the area from which oxygen is absorbed we did not modify the area from which carbon dioxide was evolved.

In dilatation of the heart there was dilatation of the right ventricle without change in pulse. If a man were not very expert in percussing cardiac dilatation he wold miss it. Few men, I think, can properly percuss the right border of the heart.

In some of the cases there was bronchostasis of the entire lung. Why these patients should get dilatation of the right heart I cannot imagine. Gas poisoning is not a very new thing, but its pathology has not been described. From what we see in the literature I should say that the explanation of dilatation of the right ventricle and right auricle is the presence of multiple thrombi in the arterioles. The inhalation of alkalies has been described. The plasma will do all the alkalies are designed to do.

Patients have bronchopneumonia with much the same physical signs as in civil hospitals.

Another phenomenon is hemorrhage from the alimentary tract. There is history of headache, with vomiting, air hunger, etc., shortly after gas poisoning. In two or three days there will be bloody stools, with only slight elevation of temperature. A moderate amount of tenderness is present along the whole course of the colon, and the man has eight to ten passages a day. There is a considerable amount of mucus present, but the stools do not have the appearance of dysenteric stools. From their character one would conclude that the man was having hemorrhage in the lower ileum and upper colon region, but that the condition was not infectious. In two days the blood disappears and the stools are normal. In infectious dysentery this does not occur.

A patient may show cyanosis, edema, bronchostasis and apparently is not himself. There is a temperature of 101°; there is extreme weakness, and the man asked to lift his legs shows that he has but little strength, and all astereognostic sense seems to be gone. There is no evidence of involvement of the cranial nerves; patellar, ankle and Babinski reflexes are present. On the seventh day the temperature is 106° and the patient in profound coma. Lumbar puncture shows a perfectly clear fluid. Autopsy the following day showed the entire corona to be speckled with hemorrhage, the corpus callosum being the favorite seat. The dorsal

cord showed the same condition, with hemorrhage in the white matter. This was the reverse picture of encephalitis. My only explanation is the factor of anexemia. There was no disease of the liver, lymph glands or spleen which would suggest perivascular hemorrhages which these patients had. Many of the patients have hemorrhages which probably are not recognized.

The principal reason I have for the use of the oxygen therapy is that anexemia is a factor in the production of hemorrhage. Although we do not relieve the patient of air hunger, we may protect him from cerebral hemorrhage if we protect him against anexemia. It is important to have men carry with them some history of their symptoms when they have been gassed some months before coming under attention.

Before we can arrive at a rational basis of estimate it is necessary to have an estimate of the partial pressure of CO_2 in the afferent as well as in the efferent blood. Much has been published on this; I have been guilty of some of it myself. All of the data we have had thus far is wrong; we cannot base any clinical judgment upon it at all. The real difficulty is to get the partial pressure of the CO_2 of the efferent blood. This is the only thing we can find to substantiate the man's own subjective symptoms. The partial pressure in CO_2 in his venous blood being above normal, gives him a small margin for exercise. The medical officer advises such a man to return to his business; he walks several hundred yards and gives way. He is thought to be malingering, but the medical officer does not understand the pathological physiology of respiration. It is going to be an extremely important matter to have some method by which we can exercise very accurate criticism over the permanent disability of men who have been gassed. Thus far there has been developed no method of objective observation by which we can determine whether a man is malingering or is experiencing all that he appears to experience.

DISCUSSION

Dr. Alfred Stengel: I have little to say regarding the subject matter of Dr. Hoover's address, which interested me tremendously, but that which occurred to me in connection with his remarks, which is uppermost in my mind and which has amazed me more than anything else in connection with this war, is the great amount of scientific advancement which has come out of a situation in which we thought there would be opportunity for nothing but attention to sudden emergencies. I have been impressed with what has been learned in regard to respiratory problems associated with gas injury, of what has been learned about the forms of acute jaundice of nephritis, whether we call it trench nephritis or regard it as the acute form seen in civilian life, of bacteriology. There has been an entire revision in regard to the culture of organisms.

We who have been interested in problems of clinical medicine know how much Dr. Hoover has contributed in the past upon the study of the physiology of the respiratory conditions. It is very gratifying to feel that he had the opportunity while in France to carry these studies further. What he has said concerning some means of evaluating the strength of endurance or of the health of the people who have been gassed will also apply to circulatory problems. These are the great problems confronting the men not active at the front but at the base hospitals. It is to be hoped that methods will be developed enabling us to take advantage of these cases. It is perhaps in the meantime to be borne in mind by all of us that what appears upon the surface in these cases is not always what is actually the case; that these men apparently without diseased conditions may nevertheless be incapacitated. These are some of the reflections occurring to the mind of one like myself who has no experience in the subject matter of the address which has interested me, as I am sure it has everyone else.

Dr. Thomas McCrae: Dr. Hoover's remarks have been of particular interest to me, and they demonstrate that men may see the same subject from different aspects. Dr. Hoover states that in trench nephritis he saw nothing different from what may be seen in civil medicine. If we take one case of trench nephritis and one case of streptococcic nephritis I agree with him, but taking 50 cases of one and 50 of the other I disagree with him. One thing which impressed me particularly was the persistence of hematuria in the trench nephritis. While we see that occasionally in civil life we do not have a large proportion of cases with hematuria lasting for months in a patient otherwise well. As I saw trench nephritis I did not

find hypertension in association with dilatation of the heart. The blood-pressure is curiously variable and is often increased through the day. With high or with a persistently low tension I found dilatation just the same.

I agree that the term "shell shock" is a very unfortunate one. Under the heading of war shock or "shell shock" we have a number of things. There are a certain number due to minute hemorrhages in the brain. I have seen a picture very much like these cases of shell shock in individuals suffering from concussion. These men have a definite organic condition. Another group is hysterical, and in this suggestion lays a large part. I talked with a number of men who had been in the front lines and they said that in the first year of the war they had no shell shock. The experience with the suggestion cases was particularly interesting. For example, among a dozen I picked out the most intelligent one for treatment. In about four days he was perfectly well so far as the usual outward symptoms were concerned. When I had finished his treatment he said to me, "Why didn't I know this before I went up to the line? If I had known this I never would have had shell shock; now I realize that I expected something to happen." I set this man to work on the others and he was the most useful "intern" in the hospital and succeeded in helping a number of the others by explanation, suggestion and encouragement. Another group is made up of the psychasthenics. Anything would upset them. We have heard much of Graves's disease being the picture of fear, and I should like to ask Dr. Hoover how many patients with shell shock show the picture of exophthalmos and of Graves's disease.

The rarity of exophthalmos observed by Dr. Hoover agrees with my experience. I did not see a typical case of hyperthyroidism. As to the gassed patients, the pigmentation of some of them was extraordinary. Hemorrhage of the bowels I did not see. There are some late results; for example, in one case sudden abdominal pain, vomiting and tenderness with rigidity came on in which, however, we did not operate, the symptoms clearing up within three or four days. Regarding the late results, while I saw several hundred cases I did not see one man who after recovery has a single objective sign. The difficulty in these cases is in deciding what to do with them and whether they can be returned to the war.

The application of scientific work to the problems of the war is one of the most inspiring experiences. The wounded are receiving as good treatment as is possible to receive in almost any hospital in the world. This will continue because the American physicians will carry on the work from the point to which the others have brought it in the three years. We may feel that the men in the war hospitals will receive better care and scientific study than would be given in nine out of ten hospitals at home.

Dr. H. A. Hare: The speaker of the evening made the statement that not one in 500 was able to properly percuss the right side of the heart. As that figure about represents the membership of this body we must conclude that all but one of the Fellows of this College are greatly behind the times. If it is proper for Dr. Hoover to make that statement it seems to me it may not be out of place to ask some questions in regard to the theories which he has advanced and the proposition which he has put upon the blackboard. As he went through some of these diagrams on the blackboard I confess that I had a feeling akin to that which came over me when I read the book by Haig on *Uric Acid as a Factor in Disease.* When you read this book for the first time you conclude it is the family Bible. At the second reading you find that nearly all propositions are based upon fundamental error—Dr. Hoover will pardon me—I do not mean to go so far as to say that his theories are based upon fundamental errors—but my contention is that there the errors are about as constant as the errors that support the view that but one Fellow of this College can percuss the right heart.

An important point not touched upon is that of the blood-pressure in regard to CO_2 and oxygen. It does not seem to me that anything has been said explaining this so-called mouse-colored appearance of the patient.

I do not think the fact of these men collapsing after walking a few hundred yards is a different finding from that in men anywhere with emphysema.

Another point of interest is that Dr. Hoover took it for granted that certain parts of the lungs were emphysematous and others were not. He did not tell us of autopsies in which the margins were emphysematous and the others were not. He may have very good evidence that this is true, but he did not present it.

I hope that Dr. Hoover knows me well enough, and knows this College well enough, to know that what I have said is not said in an unfriendly spirit. I would not have go unchallenged, however, the claim that only one of the Fellows of the College could percuss the right side of the heart.

Dr. Walter G. Elmer: I should like to ask Dr. Hoover the effect of the blistering gas on the mucous lining of the epiglottis and pharynx and the nostrils?

Dr. Hoover (closing): If these men should inhale the gas a longer time autopsy would show its effects in the bronchi and epiglottis. In some cases there was a necrosis of the entire mucosa on the posterior aspect of the epiglottis. I have not the honor of being acquainted with all of the 450 Fellows of the College of Physicians of Philadelphia, and, in fact,

I would suspect that each one of the Fellows would certainly represent one man in 500; so I think Dr. Hare is rather misquoting me. Now that Dr. Hare has held me up, perhaps I should raise the number to 600. I know of nothing so easily done as percussion of the right border of the heart, and it was one of the worst problems met in my clinic. Regarding my reason for saying that the borders of the men's lungs were emphysematous, I would not question that Dr. Hare's man had emphysema, but these men who had gas poisoning and recovered did not have emphysema. Dr. Pearce, of the Lakeside Hospital, evolved an interesting thing. (Demonstration on board concerning percentage of CO_2 in determining blood-pressure.)

APPENDIX

PROCEEDINGS

OF THE

SECTION ON OPHTHALMOLOGY

JANUARY TO DECEMBER

JANUARY 18

Unusual Type of Familial Retinal Degeneration

Dr. William Zentmayer exhibited a patient with an unusual type of familial retinal degeneration. The patient was a boy, aged nine years, whose sister, aged ten years, had been exhibited at a previous meeting. Scattered throughout the retina, but especially grouped about the macula and along the course of the superior and inferior temporal arteries, were white or yellowish-white disciform lesions, mostly discrete but in places confluent, varying in size from twice to four times the diameter of the main trunk of the central artery of the retina. In the R. E. the lesions in the foveal region were somewhat pigmented. The temporal halves of the nerves were atrophic. The child is healthy, well developed, and mentally sound. The Wassermann was negative, whereas in the sister there was a positive reaction. Otherwise the cases were entirely alike.

Conjunctivokeratoplasty

Dr. William Zentmayer said that from his observations he was convinced that this method of repair did not receive the attention that the results attained by it deserved. He had found it of value in recent wounds of the cornea, in prolapse of the iris following perforating ulcers, in fistula of the cornea, and in recent staphyloma.

He exhibited a woman with a corneal fistula which had been repaired in this way. Nine months before, the eye had been injured by being scratched by a baby's finger-nail. She had been treated in another service and was first seen by Dr. Zentmayer two months ago. Operation was at once advised, but was not consented to until two weeks ago. The fistula was situated midway between the center and the lower border of the cornea in the vertical meridian. The eyeball was mushy and gave considerable annoyance. A keratome was introduced at the lower margin of the cornea, and before withdrawing it to do the iridectomy it was used as a support upon which to curette the fistulous tract and the surrounding margins. An iridectomy was then made. A conjunctival flap attached to both ends was then drawn up from below the cornea, so that the fistula was in its middle. It was pressed down into the hole, and two sutures were placed at the sclerocorneal margin above and below to hold the flap. The T. of the eye is now normal, the anterior chamber restored, and the eye quiet and painless. There was a cataract which could be removed later. The technic pursued is the same as that introduced by Kuhnt and recently described by Knapp, except for the use of the keratome for support in curetting the fistula and the taking of the flap from below rather than on the side of the cornea. The latter method would seem, however, to be preferable.

The second case was one of prolapse of the iris following perforation of the cornea complicating purulent conjunctivitis. There was no longer any discharge, but the ulcer was still progressive. The prolapse was the size of a small white bean. The prolapsed iris was abscissed and a conjunctival flap after the

manner of the v. Lint cataract flap was made. It slowly slipped down and a small portion of the ulcer was exposed before healing had fully occurred. This has since closed and the anterior chamber has been reëstablished.

Dr. S. Lewis Ziegler stated that several years ago he had seen a case of fistula of the cornea in a patient from a blind asylum, which he had successfully treated by transplantation of corneal tissue. He said that this method was much used by Magitot, of Paris.

An Unusual Form of Superficial Corneal Opacity, Probably an Instance of Atypical Epithelial Dystrophy

William Campbell Posey reported a case in which the opacity affected the upper and outer corneal quadrant and appeared in the eye of a healthy young married woman some time after what appeared to be an ordinary attack of acute conjunctivitis. At first consisting of but a faint stippling of the corneal epithelium, there developed later a dense glistening-white opacity in the affected area that was arch-like in form and superficially vascular. This haze traveled slowly across the cornea, the advance being made by the steady progression of the fine area of stippling just referred to. Dr. Posey explained the condition as being one of corneal dystrophy, probably secondary to the conjunctivitis, the most marked changes residing in the epithelium, the dense white area representing the hyaline product of the changed epithelial and subepithelial elements. The patient had been irregular in attendance, and treatment had been applied very interruptedly, but massage with yellow oxide salves, and dionine, with applications of holocaine and heat had gradually caused a subsidence in the progress of the opacity, the vessels gradually disappearing and the base of the mass growing more transparent. Dr. Posey referred to two similar cases seen by Bordley, in both of which there was a history of trauma through closed lids.

Bilateral Congenital Cataracts

Dr. T. B. Holloway exhibited a patient, aged forty-five years, who had been referred to his service at the Polyclinic Hospital by Dr. Ealer. In each lens, situated in the posterior cortical layers, there was a triangular opacity with its base down, the width of the base being about 3 mm. as seen with a +7.00 lens. It was made up of innumerable closely packed dots, some discrete, others confluent. With oblique illumination the opacity could be seen to conform to the natural curvature of the posterior portion of the lens. About the lens in the anterior cortical layers could be observed a few scattered and discrete punctate opacities. The patient had had seven pregnancies, the last five resulting either in the early death of the infant or in miscarriage. A serum Wassermann test was negative. No known similar conditions were in the patient's immediate family.

Dr. Holloway referred briefly to some of the various types of congenital cataract, especially to the patient shown before this Section several years ago by Dr. Crampton. It was recalled that in that instance the triangular opacity was centrally located in a disk and that the apex was down.

Ring-shaped Opacity in the Posterior Portion of the Lens

After briefly referring to the ring-shaped opacity as described by Vossius, Dr. T. B. Holloway referred to a patient whose history had been recently reported by Magruder, in whom there had been observed, after trauma, an opacity in the posterior portion of the lens. He then referred to the following three patients, in none of which was there a history of trauma:

Case 1.—S. B., aged twenty-two years, first came to Dr. de Schweinitz's service at the University Hospital in May, 1906, with specific postneuritic atrophy. In October, 1915, he was referred from the hospital to the clinic for examination, at which time there was noted in the posterior portion of each lens a very delicate ring-shaped opacity made up of punctate dots, and which measured

about 4 mm. in diameter. As a result of his pronounced atrophy the vision of the right eye was 2/150 and of the left 6/150. Chancre was admitted at the age of eighteen years. In the past he had used alcohol to excess. There was a general adenopathy, moderate pyorrhea, soft systolic murmur, systolic blood-pressure 128, diastolic 80. Urine and serum Wassermann were negative.

Case 2.—H. T., aged sixty years. First seen in Dr. Francis Sinkler's clinic at the Orthopædic Hospital and Infirmary for Nervous Diseases. There was a past history of partial hemiplegia. The existing symptoms warranted a diagnosis of cerebrospinal syphilis. The pupils were slightly irregular in contour, with distinct tendency to miosis, but there still remained the faintest light reflex with condensed light. The pupils became pin-point in accommodation and convergence. The disks were somewhat dirty in appearance, but with a suitable correction the vision was normal. In the posterior portion of each lens there was a very delicate ring-shaped opacity made up of pin-point dots, with a few scattered tiny opacities toward the periphery. A serum Wassermann was negative, but a spinal fluid Wassermann was positive.

Case 3.—Mrs. H. W., aged forty-one years. First came to the University Hospital, owing to asthenopia, in October, 1915. The patient showed a moderate amount of anemia and had a nephritis. Scattered through the anterior stromal layers could be noted some fine lens dust and a few dots, some of which, by oblique illumination, presented a delicate blue tint similar to the appearance seen in some cases of congenital punctate cataract. In the cortical layers, posterior to the nucleus, there was a vague circle of punctate dots 3 or 4 mm. in diameter, analogous in appearance to that seen following concussion of the globe. The right disk showed a suspicious pallor. In the left eye there were several small vague foci of retinochoroidal disturbance between the macula and disk. Unfortunately her medical data had been mislaid.

Dr. Holloway called attention to the fact that the lesions shown in these three non-traumatic cases could not be differentiated from the so-called Vossius ring-shaped opacity except from its

location, which he believed to be in the lens between the nucleus and the capsule, but not capsular. He was not certain as to whether they were congenital or acquired, but from the fact that all of them had serious constitutional conditions, and two of them had delicate lens changes, he believed the evidence would point toward the latter.

Dr. Harold G. Goldberg reported a case of pulsating exophthalmos with the following history: In March, 1916, the patient was struck in the left temporal region with a heavy steel bar. A few days later left external ophthalmoplegia developed, which condition had persisted with very little change until the present time. One month after the receipt of the injury a throbbing sensation was felt over the opposite temple which grew steadily worse until five months later the deep scleral vessels of the right eye, especially those on the temporal side became infected, the conjunctiva edematous, and the eyeball became somewhat proptosed. With a stethoscope a loud swishing bruit, synchronous with systole, was heard over the temporal bone on the right side and not transmitted beyond an area more than 10 to 12 centimeters in extent. The treatment consisted of pressure bandaging and the liberal use of mercurials and iodides, but very little if any improvement had been noted.

Recurrent Neuro-epithelioma

Dr. G. Oram Ring exhibited a child, aged eight years, showing the result of the removal of an extensive recurrent neuro-epithelioma from the orbit by the electrothermic method. The case is believed to have been the first so treated.

Ten days following the previous exhibition before the November meeting of the Section it had attained markedly increased proportions. It measured twenty inches in circumference and projected about six inches beyond the orbital rim. Ulceration and bleeding had begun and the odor of necrotic tissue was intense. As previously reported it was regarded as inoperable by surgical means, the fear being entertained that the bleeding could not be

controlled, Dr. Risley having reported a similar case in which the child died upon the table.

The patient was apparently rapidly failing, and it occurred to Dr. Ring that its removal by the electrothermic method might be possible.

The high-frequency d'Arsonval current not being available at the Episcopal Hospital the child was admitted to St. Agnes's Hospital by courtesy of Dr. Dorrance, and was seen in consultation by Dr. William L. Clark, with the view to a confirmation of its removal by electrical means. The removal of the enormous growth flush with the orbital margins was successfully accomplished by Dr. Clark by means of an ecraseur around the base and the inactive pole upon its surface. The strength of the current used varied from 1500 to 2500 milliampères during the snaring.

The desiccation and curetting of about two-thirds of the orbital contents was then accomplished.

At the end of ten days evisceration of the orbit was completed by ordinary surgical means, the hemorrhage being controlled by the desiccating current in a manner to be described by Dr. Clark.

The bony walls of the orbit have gradually become lined with healthy granulation tissue; one massive dose of *x*-rays was applied to the orbital apex and several of minor strength.

February 10, 1917, the child's health was greatly improved, with no sign of recurrence.

Discussion of Dr. Ring's Case of Recurrent Neuro-epithelioma

Dr. William L. Clark said that the case was unique in his experience. When Dr. Ring consulted him regarding the possibility of treating it by an electrothermic method he was doubtful as to the possibility of removing the growth and evacuating the orbit successfully, but after consideration he decided that a chain snare, which is sometimes used to separate lesions such as pedunculated uterine fibroids, might serve the double purpose of a current conductor and a snare. With this idea in mind, experiments

were performed with beef liver, utilizing the bipolar d'Arsonval current, with the chain snare approximating the base and a flat disk electrode on top. It was shown that coagulation was evenly distributed in the tissue approximating the snare, and that there was also coagulation in a straight line between the snare and the disk electrode. After these experiences it seemed that he might undertake the case in question with hope of success.

Accordingly, under ether anesthesia at St. Agnes's Hospital, November 27, 1916, the operation was performed. Four thicknesses of rubber dam were drawn over the growth and brought in contact with the pedicle to protect the surrounding healthy skin against the current. The snare was set in place at the pedicle and the disk electrode pressed against the top, both having been connected by wires and attached to the transformer which generated the d'Arsonval current. A current varying from 2000 to 2500 milliampères was used, and as the growth was coagulated the snare was gradually tightened, until at the end of about ten minutes the growth separated flush with the orbit, without appreciable loss of blood. The remaining growth in the orbit was treated by the same current, but with a different technic. A moistened asbestos electrode was placed on the patient's back and the current delivered to the growth in the orbit from a metal point set in an insulated handle. After coagulating the tissue to a depth consistent with safety it was curetted away. When the patient went off the table the entire growth had not been removed. In ten days there was some recurrence, when on December 9 a second operation was performed, at which time, in addition to treatment by the current, Dr. George M. Dorrance stripped the periosteum from the orbit instrumentally and the entire orbit was cleaned out.

There has been no recurrence since the second and last operation on December 9, the wound healed rapidly, and the patient has recovered her former health and strength. Dr. Clark believed the freedom from recurrence had been partly due to the *x*-ray treatment administered by Dr. Schmidt two weeks after the operation according to a technic to be described.

Dr. William H. Schmidt said that the *x*-ray treatment of this case consisted in giving massive doses of *x*-rays from a Coolidge tube. A nine-inch spark gap was used, distance from the anode eight inches, giving 5 milliampères for eight minutes. The filters used were three inches aluminum and one thickness of sole leather.

The first treatment was given about two weeks after the first operation, and an area including the orbit and one inch of the surrounding tissue was given a full dose. Next the tissue around the orbit was screened off and another full dose given into the orbit, making two full doses in the orbit itself. This is double the amount of *x*-rays that the normal skin could stand. Then an area on the temple was selected and another full dose was given into the orbit through the side wall. In this way the contents of the orbit received three full doses and no area of the skin received more than one.

This treatment was repeated in three weeks.

Dr. Schmidt felt that the *x*-rays had a marked effect on the case, as there was a tendency to recur before its use; but since using the *x*-rays there had been no evidence of new growth, and the condition had markedly improved.

FEBRUARY 15

The Result of a Plastic Operation for Cicatricial Ectropion

Dr. P. N. K. Schwenk showed a case of cicatricial ectropion. The outer half of the upper lid and outer canthus were drawn up and out, exposing the outer half of the globe and tarsal conjunctiva. One year ago the patient fell down a stairway, lacerating the left brow, and the consequent eversion has been a constant annoyance.

The first step in the operation was to loosen the margin of the lid from the brow and determine the size of flap necessary to cover the denuded area. The flap should be made about one-third

larger than the exposed area, as they invariably shrink. He made a flap directly out from the canthus allowed for lowering and replacing canthus in normal place. After the lid flap with a pedicle was placed in position the denuded place from which flap was taken was covered by undermining the skin all around it and uniting the edges with sutures. This left a small triangle of raw surface which he covered by taking a triangular flap from just below the outer canthus and placing it in the exposed triangle to prevent the canthus from being dragged out of its normal position. The last exposed patch was readily covered by two sutures.

He applied a bichloride vaselin compress as a dressing. Dr. Schwenk did not disturb this dressing for three or four days, as there was some danger of disturbing the flaps.

Dr. Burton Chance said that he would like to call attention to the importance of Dr. Schwenk's precaution in the matter of infrequent dressings after plastic operations. He has noted in his long association with Dr. Schwenk, whose experience in the relief of deformities by plastic measures has been remarkably extensive, that cases did best when undisturbed for several days after operation. In this connection he was reminded of the beneficial effects following the employment of a steady but moderate degree of heat, such as that obtained by the use of a so-called Japanese hand-warmer, consisting of a small tin box into which a lighted paper fuse is placed, which slowly undergoes combustion for several hours.

Cavernous Angioma of the Orbit

Dr. Burton Chance presented what he believed to be a case of cavernous angioma of the orbit. The patient was a well-developed girl, aged sixteen years. In her left eye there was noticed, in the first week after birth, a soft placenta-like mass which gradually enlarged until it occupied the upper half of the orbit. It lay between the conjunctiva and the capsule, covering the upper half of the globe. The conjunctiva seemed to be healthy and

normal, the mass having a more or less fibrous capsule. The eye, from the pressure of the mass, was rotated inwardly and downward, but when relieved of the pressure it could be rotated in all other directions. The mass extended far forward into the tarsus, in which there did not seem to be a normal cartilage. The orbital ridge was deficient in the middle third, and the roof, by digital examination, seemed to be wanting. There also was incompleteness of the external orbital plate, so that at times the mass could be felt prominently in the temple region. At the time of the first examination the mass was quite concealed by the drooping lid.

In the course of years the patient had experienced no pain or tenderness, but only the deformity. The mass had not altered, temporarily, at physiological periods, but has protruded during emotional excitement, and when she stoops, as during household occupations it protrudes or rather prolapses far out between the fissures, and always when reclining; greater protrusion occurs when the nose is blown violently. All these changes can still be manifested. One series of measurements shows the mass to have protruded 55 mm. in circumference, 40 mm. horizontally, 30 mm. anteroposteriorly, and 16 mm. vertically.

By digital examination it seems to be entirely fluid. There is no such sensation as is presented in varices. There are no pulsations or bruit. The mass could be pressed back so that the eye could be rotated fairly toward the medium line, affording opportunity to view the fundus, which is, except for distinct astigmatism, healthy.

Five days ago the mass was aspirated and four syringefuls, amounting to 20 c.c., of chocolate-red blood was withdrawn. By accident, however, counter-puncture was made and air entered the sac. A roller bandage was applied and pressure maintained for three days, but on the removal of it the mass was found protruding from the fissure and did not spontaneously retract as heretofore; and, on palpation, the sensation was as though clotting had occurred. Roentgenograms show no connections with the frontal maxillary or sphenoid sinuses. Dr. Chance is of the opinion that the case is one of circumscribed cavernous angioma,

and he intends to undertake the dissection of it, expecting to find a capsule sufficiently fibrous to favor such an operation.

Dr. William Zentmayer said that the case was similar in its nature to intermittent pulsating exophthalmos, the difference consisting merely in the position of the varix. (This case belongs to the second group of Scheffel's classification of cases of intermittent exophthalmos.) The condition of the bony orbit, he thought, was due to malformation rather than to erosion.

Nodular Degeneration of the Cornea

Dr. Burton Chance exhibited a case of nodular degeneration of the cornea in a negro woman, aged about sixty-five years. The history is most uncertain. The patient's attention was first drawn to her eyes after receiving a blow upon the sight while chopping wood, some time in the past twenty years. Her condition at that time, she said, required the attention of the "doctor," who gave her rather strong medicines, one being "iodin," or "the iodide," following the course of which all her hair fell out, so that she now wears a wig.

At first glance one is inclined to regard the case as one of blue irides in a negro, with a large dense leukoma in the right eye; but, on closer inspection, it can be seen that the corneas are pervaded by a hyaline granular sheet beneath the superficial layers. The surface of each cornea is smooth and sheds staining fluids. The granules are quite dense at the periphery, but fade as the summit of the cornea is approached, so that the papillary spaces are comparatively transparent. The outer zone of each cornea is clear. In the lower temporal quadrant of the right is a more or less triangular pearly area; it is densely opaque, with a crystalline iridescence. Near to it bloodvessels run across the limbus superficially, but because there is no vascularity elsewhere in either eye it is presumed that the injury spoken of occurred here. The woman is quite able to go about alone, but her vision is so much obscured that she can no longer serve efficiently as a cook.

Solutions of atropin effect wide dilatation of the pupils, through which the funduses can be illuminated, in neither of which are there any gross shadows or reflecting areas; her light perception in each eye therefore is good in all fields, and it is presumed that the funduses are healthy. The woman has three children, a son, aged thirty-nine years, who accompanied her to the hospital has a broad and complete arcus encircling each cornea, the substance of which arcus is identical in appearance with the substance of the plaques in his mother's corneas.

The presence of this case at his clinic reminds Dr. Chance of the somewhat similar cases he reported as having occurred in a man and his son in 1913, but the present instance is singularly different from those and from others within his knowledge, insofar as the centers of the plaques are clearer than the outer portions. In the father of the first group crystalline areas were noted, which sparkled in the manner of the sparkling of the large area presented in the woman shown tonight.

The woman has come under his observation so recently that Dr. Chance is not ready to report on the probable cause nor to outline a course of treatment. In the case of the young man previously reported, iridectomies gave greater illumination, so that he has been able to go around alone safely, even to the taking of long journeys, he having visited Dr. Chance at his office unaccompanied. It is likely, therefore, that iridectomy might be serviceable in the case under observation.

Dr. William Zentmayer said that an important point in the classification of this case is the family history. If the case is one of nodular keratitis it will probably be found to be hereditary.

Hole at the Macula

Dr. Burton Chance exhibited, because of its general interest, a case of "hole at the macula," following a contusion of the globe in a dynamite explosion in September, 1916, after which the sight was totally annihilated. When first seen by Dr. Chance three months later there were a number of hemorrhagic areas together

with diffuse edema of the retina which have become absorbed, and below the "hole," at about two diameters' distance is an almost circular darkly pigmented area. The presence of these two spots recalled to his memory a case of "unusual atrophy of the choroid," which he had reported in 1913, in which two circular holes were found to the temporal side of the disk. The "holes" in that case were not much unlike in appearance "holes at the macula," especially such as is shown in the case under discussion, a water-color sketch of which he had had made by Miss Washington. This sketch is the last which that accomplished, and now lamented, artist had made, which was delivered to him the day before her fatal illness.

Heishrath-Kuhnt Operation

Dr. William Zentmayer exhibited a case of trachoma upon which the Heishrath-Kuhnt operation had been made some weeks previously. The improvement in the patient's condition has been very marked. The cosmetic result is also good, as the palpebral fissures are of even width.

A Case of Sarcoma of the Orbit

Dr. William Zentmayer presented the following case: S. S., female. First seen at Wills Eye Hospital January 20, 1917. First noticed growth in upper lid three years ago. It had slowly, progressively, and painlessly increased in size. R. E., 6/6. L. E., 6/15.

In the orbital fold of the upper lid of the L. E. extending from a point a little to the inner side of the middle line to the outer angle there was an oval tumor measuring approximately 40 x 25 mm. The surface of the growth was uneven, but could scarcely be termed lobulated. The mass was outside of the orbital cavity, except at the outer end, where the pole was turned inward behind the orbital margin. It was movable except at its outer extremity, and was unattached to either the skin of the upper lid or to the conjunctiva. The palpebral conjunctiva was congested and

granular, and presented a small yellowish area in the position of the growth. An incision was made into this spot, and on withdrawal of the blade a small friable granular mass protruded.

Under ether an incision was made through the overlying tissues the length of the mass, and the growth was enucleated. This was accomplished with comparative ease, as the tumor was encapsulated. Three fine catgut sutures were used to close the opening in the orbital septum, and a like number of silk sutures to unite the skin incision. Later there was a somewhat indrawn, scarcely visible cicatrix corresponding to the normal fold of the sulcus together with a slight drooping of the lid.

Dr. Brinkerhoff, the pathologist to the hospital, gave the following report: The specimen consisted of an irregular mass of tissue measuring 35 x 22 x 18 mm. in its chief diameters. The external surface was smooth. Attached to the posterior surface there were some muscle fibers and fat. On cut section the surface was soft and friable and had the appearance of chicken fat. Microscopically the specimen consisted in the main of a frail connective-tissue framework, supporting, in some instances large, in other instances smaller, masses of sarcoma cells. Besides the connective-tissue framework there was carried along a moderate blood supply, in the shape of imperfectly formed bloodvessels. The sarcomatous tissue predominated. The diagnosis was "a large round-cell sarcoma."

Traumatic Notch in the Lens

Dr. William Zentmayer presented a case of traumatic notch in the lens. The patient was a girl, aged fourteen years. Seven years ago she had been struck in the right eye by a baseball, and since then has seen but little with this eye. V. = 1. p. The lens was subluxated and presented at the inferior portion of the equator two shallow notches separated by a teat-like projection of the lens substance. Suspensory ligament fibers can be made out only at the latter point. Dr. Zentmayer thought that Dr. Crampton's suggestion that the notches were due to the updrawing

of the lens capsule at these points, the capsule being held in its normal position at the location of the teat by the zonule fibers, was probably correct.

There were extensive pigment changes in the choroid and retina probably the result of hemorrhage at the time of the accident.

Contusion of the Eye with Rupture Extending Across the Optic Nerve

Dr. Edward A. Shumway reported a case of contusion of the eye, with rupture extending across the optic disk. The patient, a child, aged eight years, was struck in the left eye by a stone thrown by a playmate. Following the blow he vomited several times and was dazed for some hours. There was no wound of the eyelids or eyeball, but hemorrhage into the anterior chamber and vitreous obscured the iris and fundus. Vision was reduced to the perception of hand movements on the temporal side below. Later an iridodialysis was found at the lower border of the iris, and when the vitreous cleared up, in the course of four months, a tear was discovered extending across the lower third of the optic nerve. At this position there was a depression, over which ran a band of newly formed connective tissue. The retinal bloodvessels were interrupted at the disk margin, and there was a broad area of atrophy of the choroid bordering the tear, and much superficial disturbance of the retina beyond.

Rupture of the optic nerve in its orbital course, and also partial or complete avulsion of the nerve from the sclera, at the level of the lamina cribrosa, are not uncommon where the orbit has been penetrated by a foreign body. But there are only three cases on record, where a tear across the nerve has occurred from contusion without penetration, the usual rupture being in the choroid. In each case the tear has been at the lower border of the nerve, and Dr. Shumway thought that the blow produces a sudden violent rotation upward of the eyeball and thus causes a separation of the nerve from its scleral attachment.

Dr. P. N. K. Schwenk referred to a case of an engineer who was struck in the right eye by an owl while driving his locomotive. He suffered a ruptured choroid, and central vision was destroyed.

Thrombosis of the Superior Branch of the Retinal Vein

Dr. Frederick Krauss reported a case of thrombosis of the superior retinal vein in a woman, aged forty-eight years, suffering from high blood-pressure and a latent syphilis. The history indicated an ocular lesion nearly one year old. The most interesting detail was a replacement of the thrombosed section by innumerable fine corkscrew-like vessels surrounding the opaque areas in the retina and an enormous dilatation of a macular vein. This collateral circulation probably explains the almost perfect field for white, colors, and good central vision.

Instrument for Demonstrating the Elementary Principles of Refraction

Dr. T. B. Holloway demonstrated an instrument that had been of considerable service for the teaching of the elementary principles of refraction. It was not only of service in the demonstration of various refractive errors, but was likewise of service in teaching the combination of lenses. With the same instrument the angle gamma and alpha could be readily demonstrated, and with but slight modifications it could also be utilized for the demonstration of images formed by mirrors and by lenses.

MARCH 15

Symposium on Ophthalmia Neonatorum and Gonorrheal Conjunctivitis, Their Relation to the General Hospital

Dr. George E. de Schweinitz said that with certain facts we are well acquainted, to wit, that about 110,000 men, women and

children in this country are within the strict definition blind About one-fourth of this number need not have lost their sight. The causes of their misfortune are in large measure preventable. These 25,000 persons by their blindness deprive the country yearly of about $8,000,000 worth of productive labor. A very large proportion of these 25,000 persons who ought not to have lost their sight have been deprived of it because of ophthalmia neonatorum, which is responsible for 25 or 26 per cent. of the blindness in eleemosynary institutions, schools for the blind, etc., and is the cause of approximately 8 per cent. of the blindness in most of the regions of our country. The ophthalmia neonatorum which causes this blindness is in most instances due to the gonococcus, which is responsible for this disease in about 65 per cent. of the cases. In general terms, measures devised and in operation for the elimination of this preventable cause of blindness are education, compulsory notification, punishment by law of offenders against properly constructed legal regulations, and compulsory prophylaxis. It is not necessary to discuss the value of these measures. Each has its value, but this is not enough. Inasmuch as all properly managed hospitals at the present time have as part of their equipment a Social Service, the difficulties of the home treatment of ophthalmia neonatorum have been lessened, and the follow-up system has been productive of admirable results. But even the Social Workers and the follow-up system are not always able to control home treatment, and the evidence is strong that the best results are secured in wards properly constructed and conducted for the management of this disease, the best example being the Gardiner Ward of the Massachusetts General Hospital. But many hospitals have no such wards. Until comparatively recently,[1] in the City of Philadelphia, the Philadelphia General Hospital and the private rooms of St. Joseph's Hospital were the only places where cases of ophthalmia neonatorum and adult gonorrheal ophthalmia were admitted. In other words, many hospitals had no accommodations for such cases, and have not

[1] At present several hospitals have made provision, for example the Lankenau Hospital, St. Mary's Hospital and the Children's Hospital.

got them now, and they won't admit them. Some hospitals, like the Preston Retreat, the Maternity Hospital of the University and of the Jefferson Medical College, take care of the babies who acquire the disease when born in their own wards, but they do not accept cases of this character from the outside. Dr. Holloway investigated 42 hospitals in Pennsylvania. Only 2 returned an unqualified statement that ophthalmia neonatorum patients would be accepted. Very properly he concludes that hospitals receiving State aid should be compelled by law to provide suitable accommodations for the victims of ophthalmia neonatorum. Furthermore, society in the general sense of that term which supports certain other hospitals, not accepting State aid, should demand that they make similar provision. Committees which exist for the prevention of blindness should force this issue with all the influence they can command, not only because it represents a real work of humanity, not only because it relieves the city ward in which the child may exist from a distinct menace, not only because with very little expense and with absolutely no danger to other patients in the hospital, a room with a few beds could always be appropriated for these cases and a nurse detailed when any of the patients were its residents, but, if you choose, from a commercial stand-point the matter should be urged, because it would mean a reduction of the blind from this cause, and therefore a lessening of the economic loss to the commonwealth in which these hospitals exist. Many computations have been made. In one State it has been ascertained that 100 of the young blind have lost their sight from ophthalmia neonatorum. These young persons will eventually cost the State $300,000 for education, but the economic loss to the commonwealth because of their life-long dependence will be many times that sum. Three years ago in the State of Pennsylvania $123,000 was appropriated by the commonwealth to four institutions or organizations for the blind, and approximately $32,000 of this money was devoted to the welfare of those who were blind from ophthalmia neonatorum. As Dr. Holloway has pointed out in his admirable report, it costs the State of Pennsylvania approximately ten times as much to educate

one blind child as it does to educate one seeing child. These figures should be stored up in the memories of those who make our laws.

Dr. A. D. Whiting, Medical Executive Officer of the Germantown Hospital said that gonorrheal ophthalmia and ophthalmia neonatorum are classed by the management of a general hospital as infectious, venereal diseases. Hence they come under the ban of the rule of most general hospitals which provides that no infectious or contagious disease shall be admitted; or under the ban of the rule which prohibits the admission of venereal diseases. These are just rules when applied to the majority of general hospitals and should be enforced, because these hospitals are not equipped to properly care for these cases without neglecting or endangering the patients generally considered suitable for admission to a general hospital. A general hospital is supposed to be equipped to properly study, treat, and care for patients afflicted with conditions which in a general ward would not endanger the comfort or well-being of other patients admitted to such wards. They are not equipped, in a majority of instances, to properly study, treat, and care for patients suffering from communicable diseases which require isolation with all that the term applies in the form of special, exclusive nursing; special, exclusive diet trays with the care of the tray utensils; special, exclusive disinfection and laundering. If not properly equipped, the hospital does an injustice not only to itself by admitting such cases, but an injustice to the other patients in the hospital and to the community in general, because it would be assuming obligations which it could not fulfil; it would result in removing from the other patients that protection against communicable diseases which is assumed when they enter a general hospital.

As a general proposition, the nursing staff of a general hospital should be equipped both as to numbers and attainments to care properly for each and every case admitted to the hospital. But the majority of hospitals have nursing staffs that are not prepared, especially in numbers, to care for cases that must be isolated, without either neglecting really suitable cases, or being so over-

worked that the general nursing deteriorates. And this is especially so when a case of gonorrheal ophthalmia is considered. According to some authorities the infection reaches its height in about two weeks. During that time there must be practically constant attention, both day and night. This means that at least two nurses must be taken from their regular duties and must devote themselves solely to the one case. One might imagine that the removal of two nurses from regular staff duty should not interfere with the routine work of the hospital. As a matter of fact, very few, if any, hospitals have a greater number on their nursing staff than is actually required to do the routine work. Again, it may be argued that the hospital would have to care for a case of gonorrheal ophthalmia which developed in the hospital. Very true. And the hospital would care for such a case to the best of its ability, hiring special nurses for the purpose if necessary. But that does not signify that the hospital should seek trouble and expense by admitting a case, for the care and treatment of which it is not equipped.

Another drawback to the admission of these cases, in most general hospitals, is the lack of isolating wards or rooms. If these cases could be cared for in a general ward, there would be a greater leniency toward admitting them. The hospital must protect the other patients from infection, so far as possible, and therefore the management must refuse admission until proper housing facilities can be afforded.

A very serious objection to the admission of gonorrheal ophthalmia to a general hospital, in the minds of the lay management, is the thought that it is a venereal disease. Possibly it will be argued that this stand of the management is due to prejudice or ignorance or both. Be that as it may, it is nevertheless a fact that a great many hospital managements hold the same views. Stokes states that in "1914 it was estimated that the city of London, with a population of 7,000,000 had 163 beds actually available for the care of sexual diseases. The Sydenham Royal Commission has just found the same condition throughout Great Britain. Of thirty general hospitals in New York City, a recent

investigation showed that only ten receive recognized cases of syphilis in active stages. Nine receive adult cases of gonorrhea needing hospital attention, and three receive and treat active gonorrhea in little girls. Thirteen of thirty will not even receive medical cases with known syphilis or gonorrhea." Until this prejudice, ignorance, or whatever you wish to call it, is overcome, lay managements will continue to exclude venereal diseases. It must be remembered, moreover, that to the lay mind, venereal diseases are loathsome and contaminating; many managers think it almost criminal to allow, much less command, young pupil nurses to come in contact with such loathsomeness even in a professional way.

The only general hospitals that should admit cases of gonorrheal ophthalmia are those that have a special ophthalmological department, sufficient and suitable isolating rooms, and a large enough nursing staff to allow of special nursing without interfering with the routine work of the department or of the hospital.

I believe that every general hospital pretending to maintain an eye service should be so equipped and that all cases of gonorrheal ophthalmia should be admitted to such a department.

Dr. A. A. Cairns, Chief Medical Inspector of the Bureau of Health of Philadelphia called attention to the Act of Assembly No. 295, approved June 5, 1913, which provided for the prevention of blindness, by requiring the reporting of cases of ophthalmia neonatorum (inflammation of the eyes of infants) by physicians, midwives and others, and requiring the reporting of results of treatment of case of said disease, and fixing a penalty for violation thereof.

The reporting of ophthalmia neonatorum is compulsory in thirty-seven States.

He felt that there was no good reason why cases of ophthalmia neonatorum should not be treated in any hospital.

The Division of Child Hygiene, Bureau of Health, dispenses to all midwives ampoules containing one per cent. (1%) solution of nitrate of silver.

Dr. Cairns stated that any case of ophthalmia neonatorum

reported to the office of the Bureau of Health (which was always open) would be visited by a medical inspector who would explain the gravity of the disease to the parents and endeavor to have the case removed to a hospital.

Dr. J. M. Baldy, Chairman of the Bureau of Medical Education and Licensure of Pennsylvania said that his interest in this matter was purely from an administrative stand-point.

Several years ago he was called from his office during the evening by the supervisor of midwives of the Philadelphia district to the house of a young Italian family where he found a young mother with a first baby on her knees which was suffering from the well-known picture of ophthalmia neonatorum. The only hospital in Philadelphia available into which to send this child and mother for treatment was the Philadelphia General Hospital. The district physician through whom application was to be made was out of town for the night and there was no certainty that he would be home even in the morning.

Such a condition in a city of the size of Philadelphia Dr. Baldy thought not only pitiable but outrageous. If hospitals were not organized to take care of suffering people, no matter what the disease might be, then he did not know what a hospital was for. The only exception to this should be cases which had been pronounced by the health authorities to be so contagious as to be unsafe for treatment in a general hospital.

The Bureau of Medical Education and Licensure during its inspections of the hospitals of the State found it the almost universal rule to exclude all of this type of cases. This was frequently done by specific by-laws. The spirit of excluding this type of case from the general hospitals had grown from several causes. First from the lack of proper information given by the doctors to boards of managers, and second from a religious prejudice of the boards of managers. The old conception was that if a man sinned he should stand the consequence of his sin: but the trouble with this theory was that it did not take into consideration either humanitarianism, the efficiency of the community or the rights of the innocent. No more dangerous class of diseases exist to any

community than this group of venereal diseases and no hospital manager can with a clear conscience turn such cases loose on the community. The hospital which commits this offence clearly fails to fulfil its obligations to the community and to those who contribute charity funds for the sake of the sick and distressed.

So far as purulent ophthalmia is concerned, the State builds institutions for housing these unfortunates after they have become blind and spends large sums in educating them and caring for them and yet this same State is asked to contribute millions of dollars a year to the aid of hospitals which turn loose this class of patients on the community to become blind and to become dependent on the State.

The Bureau of Medical Education and Licensure had weighed this matter very carefully and Dr. Baldy was glad to hear that the opinion of those present who were experts in the treatment of the eye was thoroughly in accord with his opinion as to the responsibility of hospitals in this matter. He said that this discussion had strengthened the Bureau in a conclusion to which it had already come and which it was about ready to announce, to wit, that no young medical man was properly prepared to practise his profession who was not properly educated in the treatment of venereal disease in all of its phases, including purulent ophthalmia and vaginitis; that it was unjust to the community to turn such young medical men out without this education, when the State required that each young man who went into practice shall spend a year in a hospital. It was fairly evident that unless the hospital furnish instruction in this class of diseases he could not acquire a sufficiently competent education to warrant his being sent into practice in a community. In consequence of this it would be found when the new hospital bulletin was issued that the Bureau would insist that the hospital which was unwilling hereafter to furnish material for such experience to the intern would not be placed on the approved list of hospitals into which interns might go to complete their education.

Dr. Love, on behalf of St. Mary's Hospital, and representing the ophthalmic department of that institution said he wished to

state that a ward has been assigned to cases of ophthalmia neonatorum and of gonorrheal ophthalmia. This ward was isolated, contained six beds, and was in charge of two nurses.

He believed that the number of these cases could be greatly reduced, and the eyesight of many children be saved, if the law relating to this subject were more rigidly enforced, and if ampoules containing silver nitrate were widely and freely distributed by the Bureau of Health.

Dr. H. Maxwell Langdon stated that the Children's Hospital would take cases of gonorrheal ophthalmia in children either with or without vaginitis up to the limit of its capacity, which was a ward of four beds to be used for this purpose. These facilities might be somewhat curtailed for the immediate future from the fact that in the new hospital the quarters for the nursing staff were limited and it might be that owing to a shortage of nurses not more than two cases could be treated at one time.

Dr. J. B. Turner endorsed the sentiment of the meeting, that hospitals receiving State aid should admit cases of ophthalmia neonatorum. Also that children's homes and foundling asylums should report their cases and be compelled to have trained nurses for the care of the same, under an oculist's supervision. If the mother was given an antiseptic vaginal injection under strict antiseptic precautions before birth of the child there would be fewer cases of ophthalmia neonatorum to report.

APRIL 19

Extensive Discoloration of the Posterior Capsule of the Lens following a Severe Penetrating Wound of the Eye, Resulting in Excellent Vision

Dr. Frederick Krauss presented a patient, male, aged thirty-five years, who was struck by a red-hot piece of steel about two inches long and the thickness of a narrow lead-pencil, which penetrated the tissues just beyond the outer canthus, passing through the

ciliary region, then apparently between the posterior capsule of the lens and the limiting membrane of the vitreous, reaching to the opposite side of the lens. The patient immediately pulled out the hot foreign body, burning his fingers. He made a perfect recovery, so that in four weeks he had 5/9 normal vision. He showed a large scar beyond the outer canthus, two triangular discolorations over the ciliary body and a brownish, rust-colored, translucent discoloration running across the entire lower fifth of the lens, and a second discoloration in the outer $\frac{1}{3}$ of the lens. The rest of the lens and vitreous were clear, and the eye quiet. The x-ray was negative.

Retained Hyaloid Sheath

Dr. Wm. Zentmayer presented a case of retained hyaloid sheath in the right eye of a boy, aged ten years. Attached to the upper-inner quadrant of the posterior capsule of the lens was a white membrane which could be traced for some distance into the vitreous when it was, for a short space lost, but again became visible as a broad greenish-white mass attached to the papilla. The latter appeared to have an incomplete coloboma. The eye was blind.

Congenital Stellate Cataract

Dr. Wm. Zentmayer presented an unusual form of congenital cataract. The case was that of a child with zonular cataracts presenting stellate opacities at each pole of the clouded zone.

Dr. Zentmayer also presented two instances of symmetrical, subcapsular, punctate, annular opacities just beneath the anterior capsule of the lens.

Snow-ball Opacities of the Vitreous

Dr. T. B. Holloway exhibited a female, aged seventy-four years, who recently came under observation at the University Hospital on the service of Dr. de Schweinitz. In each eye the whole vitreous appeared to be studded with rather freely movable, small, snow-

white globular opacities. There were incipient lens changes. The fundus of each eye was not seen clearly but sufficiently well to state that there were no well-defined gross changes in the choroid or retina. The patient is now being studied from a general medical stand-point.

Dr. Holloway briefly alluded to some of the literature on the subject. In conclusion he stated that he had not made a complete resumé of all cases showing cholesterin, but had alluded to these cases because cholesterin crystals, more closely than any other opacities, bore resemblance to the type of opacity under discussion. He felt that they differed in appearance just as much as a cotton ball differs from gold and silver tinsel.

He referred to the investigations of Burdon-Cooper, who repeatedly found tyrosin in association with cataract, and especially marked in those cases associated with albuminuria and diabetes.

Dr. Zentmayer said that from the casual examination that he had made of Dr. Holloway's case the condition did not seem to him to differ greatly from synchysis scintillans. The bodies were in the anterior part of the vitreous and were enmeshed in a framework of connective tissue.

Dr. S. Lewis Ziegler had seen several such cases during the past thirty years. He referred to one case of occlusion of the pupil in which after a V-shaped iridotomy the anterior chamber filled with cholesterin crystals. He thought that some chemical change was responsible for these vitreous opacities with associated systemic disturbance.

Report of a Case of Acute Double Optic Neuritis with Complete Blindness in the Right Eye

Dr. C. E. G. Shannon presented the case of a girl, aged nine years, who had consulted a physician a few weeks previous for severe frontal headaches and was informed that the sight in the right eye was completely lost.

Examination. Right eye blind. Left eye vision equals 20/30. Pupils were unequal—O. D. 4½ mm.—O. S. 4 mm. Reactions normal. Malingering was disproved. There was no impairment in the rotation of eyeball.

Ophthalmoscopic Examination. Right eye revealed swelling of the papilla of about 3 D. associated with a grayish striated opacity extending some distance into the surrounding retina. Margins decidedly indistinct. Arteries normal. Veins engorged and tortuous.

Left eye showed swelling of nerve and striation of the retina slightly less marked than O. D.

For future study and observation, she was admitted to the Jefferson Hospital, November 15, 1916.

Personal History Negative. The von Pirquet test was negative. Wassermann also negative. Knee-jerks increased; no clonus; no Babinski; gait normal; station normal; no changes in sensation; finger-to-nose and finger-to-finger movements apparently normal.

Dr. Price stated that it suggested very strongly a possibility of brain tumor, the absence of definite localizing signs and the mental hebetude, inclining him to think of a frontal growth.

Dr. Deardoff reported chronically inflamed tonsils and adenoids, but considered these affections were not the cause of the symptoms.

Urinalysis. Negative.

The X-ray demonstrated marked evidence of intracranial pressure by reason of the exaggerated convolution depressions on the inner table of the skull, although no definite cause for the increased pressure can be determined.

Dr. Hansell saw the patient in consultation and advised lumbar puncture.

Dr. Tyson, the intern in charge, performed the operation and reported that the cerebrospinal fluid was under considerable pressure because of the force with which it escaped from the needle.

Microscopic examination of fluid negative.

On the morning following the puncture vision returned to right eye, and the child could count fingers at five feet. There was a

slight reduction of the swelling of the papilla, and the margins were more definitely outlined, vision gradually improved and within two weeks had increased to 20/100. Associated with the improvement there was a still further recision of the papillary swelling to about 1½ D. from 3 D. Vision of 20/100 with moderate elevation of the disk is still maintained.

Diagnosis. In view of the negative family and personal history of the laboratory findings, and the improvement of vision following lumbar puncture, the diagnosis in this case is uncertain.

The report of the *x*-ray demonstrating exaggerated convolution markings on the inner wall of the skull, and the evolution of the spinal fluid at the time of lumbar puncture, and finally, by reason of the absence of other signs and symptoms of cranial lesions a tentative diagnosis of chronic internal hydrocephalus may be assumed.

Dr. Holloway assumed from Dr. Shannon's remarks that he regarded the digital impressions as being dependent upon intracranial pressure. He stated that authorities were not in accord concerning the formation of these peculiar markings. He thought that in the case under discussion, if the pressure was intense enough to produce these markings on the inner table of the skull, it might be fair to assume that the delicate bony structure of the posterior wall of the orbit might be affected, and the possibility of some pathological changes about the optic foramen ought to be considered.

Massive Spontaneous Hemorrhage into the Vitreous

Dr. Leighton F. Appleman reported three cases of massive spontaneous hemorrhage into the vitreous observed in Dr. Holloway's clinic in the Polyclinic Hospital. The first case, a woman, aged forty years, had an initial hemorrhage which cleared up under dionin and atropin to such an extent that the details of the fundus could be dimly seen. This was followed one month later by another massive vitreous hemorrhage in the same eye which failed to clear up under increasing doses of potassium iodide or other measures. The Wassermann reaction was negative.

She suffered from extensive pyorrhea which was believed to be a causative factor by septic absorption.

The second case, a man, aged twenty-one years, showed a massive vitreous hemorrhage which had come on suddenly, without previous injury, and with complete loss of sight. The Wassermann reaction was strongly positive. He was given several injections of arsenobenzol, and potassium iodide, over a period of three months without favorably influencing his eye condition, although his general health was greatly improved.

The third case, a man, aged twenty-seven years, also lost the sight of the left eye suddenly as a result of massive hemorrhage into the vitreous. The right eye showed extensive connective-tissue formation in the vitreous, as of old hemorrhage, although the patient was unaware of any trouble in this eye, as his vision was normal. This case was considered specific in nature, as he gave a history of chancre nine years previously, and other findings were negative. The serum Wassermann was negative, however, and a spinal Wassermann was not obtained, as the patient left the hospital before the examinations were completed.

The various causes of vitreous hemorrhage were reviewed, as well as the different modes of treatment which have been resorted to in the hope of absorbing these large extravasations.

Dr. Krauss recalled two cases of spontaneous hemorrhages in the vitreous. The first case had copious hemorrhages which would be completely absorbed, only to recur again after an interval of about six weeks. They apparently came from the choroid, directly above the macula, as shreds of the retina could be seen extending into the vitreous at this point. The patient recovered his sight eventually without any specific treatment, but finally developed miliary tuberculosis.

The second case, a woman in which were frequent hemorrhages, all sorts of local and internal medication proved unavailing, each hemorrhage being more difficult to absorb than the previous one. The remedies recommended for this disease demonstrate their uselessness by their numerical variety.

Dr. Zentmayer recently saw a case of recurrent hemorrhages

into the vitreous in a strong boy, age eighteen years. A thorough physical examination failed to reveal any lesion. The Wassermann was negative. The von Pirquet was strongly positive. The blood count, hemoglobin and coagulation time were all normal. The left eye had but L. P. The vitreous was filled with blood. In the right eye vision equalled 6/6. There was but little blood in the vitreous but there was a zone of hemorrhages in the retina surrounding the ciliary body. Under mercurial inunctions, thyroid extract, potassium iodide and sweating, the vision in the left eye was now 6/9 but that of right eye continued to fail, new vessels and tissue forming in the vitreous.

Dr. Holloway thought that these cases were always difficult to handle in dispensary practice, and that often it was difficult, for one reason or another, to carry out proper investigations concerning their origin. He felt that the majority of these cases were due to either tuberculosis, syphilis or anemia, although other conditions might produce a similar clinical picture. He stated recently that Dr. Lamb had informed him that he had obtained excellent results from the use of fibrolysin during the active or subsiding stages. Personally he had never used the drug.

Dr. S. Lewis Ziegler referred to several cases of recurrent hemorrhage in the vitreous, some of which were due to constipation and one to vicarious menstruation. He thought many were due to intestinal intoxication. He found thyroid extract in small doses and positive galvanism the most effective form of treatment.

Serum Therapy as Applied to Pneumococcic Infections of the Eye

Dr. Louis Lehrfeld, by invitation, referred to the announcement by the Rockefeller Institute that the pneumococcus is no longer a single organism but a family of cocci composed of four different species. This had paved the way for extensive research along the lines of serum therapy for each type of microörganism. In the experience of those who have used antipneumococcus serum in

the treatment of pneumonia, only the serum of the Type I variety has given conclusive and encouraging results.

If serum therapy can be of value in the treatment of an acute pulmonary disease such as lobar pneumonia, there is every reason to believe that the same treatment could be applied with advantage in the acute inflammatory diseases of the eye caused by the pneumonia germs. The same types which are found in the sputum should also be found in the inflammatory discharges from the eye, caused by the pneumococcus.

The number of organisms procured from the eye in these infections are ofttimes insufficient to obtain proper growth on culture media. The time consumed in securing the proper growth and the time lost by inoculation of the mouse and by awaiting its death for the determination of the type, made it impracticable to await the ultimate diagnosis of type infection in eye conditions, because serious injury might result to the eye if immediate treatment was not instituted. In order to overcome this difficulty it appeared logical to add equal quantities of the sera of all types and to use this mixed treatment, as it were, in order to reach the prevalent type.

The Pneumonia Commission has therefore prepared ampoules of serum of Types I and II in equal quantities for use in eye cases.

The use of antipneumococcus serum in the eye is based solely on the properties of the various sera to agglutinate the organisms of their respective types. The eye merely acts as the test-tube and the serum instilled agglutinates and renders inactive the organisms present. It is precisely the same reaction which takes place in the Widal test for typhoid and the agglutination test for cholera. The determination of the type of pneumococcus is therefore not immediately essential and the "mixed treatment" can be continued until the type has been diagnosed by the proper laboratory tests when the specific serum can be administered.

Local instillation in the cul-de-sacs of the infected eye can only be relied upon in the superficial infections of the globe, since contact of the serum with the organisms in the deeper layers of the cornea and in the chambers of the eye could not take place readily.

In such fulminating inflammations of the eye where the deeper structures are involved, it is advisable to use the serum intravenously as in the case of lobar pneumonia. The frequency of the injections will depend entirely upon the nature and seriousness of the infection and the procedure will follow along the same course as in pulmonary infections.

The advantages to be derived from local serum therapy in the severe pneumococcic infections over the present methods of treatment are the immediate destruction of the invading organisms. Corneal ulcers are most frequently caused by the pneumococcus and opacities are a common sequel of these infections, leaving the vision more or less permanently impaired. It is for the prevention of these cases of partial blindness that serum therapy is especially advocated and for the possible prevention of total blindness resulting from complete infection of the globe.

Ocular Palsies in Infantile Paralysis. Report of Two Cases

After briefly reviewing the literature, Dr. A. C. Sautter reported two cases of ocular palsy complicating infantile paralysis, both cases being patients in the Philadelphia Hospital for Contagious Diseases in the Fall of 1916.

Case 1. — Bilateral external ophthalmoplegia in a two-year-old male infant. The palsy was first noticed about five weeks after the onset of illness. Before this the patient was in a semi-stuporous state, at times restless and slightly delirious, fever ranging around 100°. There was slight weakness of arms and lower extremities but no distinct paralysis of any muscle group. Ocular examination revealed paralysis of all external eye muscles with a moderate ptosis in the left eye which slightly deviated upward. There were no pupillary abnormalities and no changes in the eye-grounds.

Examination six months later disclosed only slight lateral ocular motility; physical and mental condition apparently good.

In view of the exceptionally long duration of the palsy, the prognosis as to complete functional restitution seemed doubtful.

Case 2.—Paralysis of the conjugate movements of the eyes in a four-year-old colored boy. One brother had infantile paralysis at the same time, one sister had succumbed to the affection one week prior to admission of case under consideration. Illness began with vomiting, fever and prostration followed by signs of a right facial paralysis. Five days after admission to the hospital paralysis of the conjugate movements of the eyes to the right was noted associated with right facial palsy and right leg weakness. There were no pupillary or fundus abnormalities. Convergence was somewhat impaired.

Examination six months later disclosed only slight impairment of dextroversion and no other palsies.

The writer reviewed 669 case histories of infantile paralysis at the Philadelphia Hospital for Contagious Diseases and found nineteen, or about three per cent., which showed disturbance of the extra-ocular muscles, including thirteen cases of unilateral sixth nerve paralysis, four of which were complicated with seventh nerve paralysis. Bilateral sixth nerve involvement occurred in three cases, external ophthalmoplegia and paralysis of the conjugate ocular movements each in one case. Ptosis uncomplicated with other ocular lesions in one case, combined with other ocular lesions in two cases. Nystagmus occurred several times. A few histories containing references only to pupillary anomalies and no other eye symptoms were purposely excluded from the list of eye complications. In seven of the nineteen cases the cranial nerves were apparently the only nerves affected.

Paralysis of the facial nerve occurred in seventy-eight patients, eighteen of whom died.

In the few cases examined ophthalmoscopically no fundus changes were noted.

In accord with the findings of previous investigators it was found that the seventh nerve was most frequently involved, then the sixth and least often the oculomotor nerve.

In reply to Dr. Hansell's question as to what percentage of cases in infantile paralysis showed palsy of the ocular muscles and

whether these differed from palsies complicating other cerebrospinal conditions, Dr. Sautter stated the percentage obtained in the case histories examined was about three per cent. (excluding facial palsies) and that in his experience limited to a few cases, the palsies clinically showed nothing typical.

A Case of Suspected Tumor of the Pituitary Body

Dr. Howard F. Hansell reported the case of a boy, aged seventeen years, who had well-marked temporal hemianopsia of the left eye only and slightly concentric contraction of the fields of both eyes. The pupil of the left eye was dilated under all conditions of light 1 mm. larger than the right. The hemianopsic pupillary reaction could not be positively proved yet the response to a bright, suddenly exposed, minute light was less prompt and less excursive by the nasal half than by the temporal half of the iris.

The interior of each eye was normal. There was not the slightest variation from the normal in the color or outline of either optic nerve.

The *x*-ray report: "Interference by pressure on one or more of the large blood channels, probably that in closest relation to the base of the brain in the region of the sella turcica or longitudinal sinus about the level of the coronal sutures."

Neurological report: "He has no disturbance of gait, station, reflexes, motion or sensation and presents no evidence whatever of hysteria."

The test by the otologist showed no loss of connection between the internal ear and the higher brain centers.

The symptoms presented by our patient are too few to permit of a positive diagnosis, yet they are of significance in pointing to tumor, cyst or hypertrophy of the ciliary body. The nature of the lesion is conjectural. The picture of normal eye-grounds persisting through four months is not inconsistent with the conception of a small tumor, possibly a cyst, which has almost completely destroyed the function of the anterior left part of the chiasm and has invaded, by pressure or inflammation, the right optic nerve.

OCTOBER 18

Operation for Contracted Socket

Dr. P. N. K. Schwenk showed a case of contracted socket in which he devised a new feature of transplanting a flap with a pedicle. The first step was a canthotomy. The conjunctiva was then undermined to the margin of the lower lid, and the skin loosened 6 mm. downward. The conjunctiva was brought into the cavity and held there by two hairpin sutures through the lower lid and tied over two pearl buttons. A large flap twice the width of the denuded conjunctiva was taken and placed in the orbit, suturing the lower part of the flap to the lower edge of the conjunctiva and the upper part to the upper edge. The flap was placed into the canthotomy angle, then the ends of canthotomized lids were united over the pedicle by a strong hairpin suture tied over a pearl button. The edges of the area from which the flap was taken were then united and a conformer was inserted. The sutures were allowed to remain seven or eight days.

The Intimate Relation between the Eye and the Ear as Shown by the Bárány Tests

Dr. Isaac H. Jones and Dr. H. Maxwell Langdon said that knowledge of the relation between the ear and the eye was first recognized in 1825, when Fleurens noted that excision of portions of the labyrinths of animals caused ocular movements and disturbances of equilibrium. At the same time Perkinge produced nystagmus and vertigo by turning human beings. Robert Bárány has elaborated and made practical application of the field of knowledge thus opened.

The ocular mechanism depends on ear stimuli for precision of movement and steadiness of fixation. Impulses from the right ear tend to draw both eyes to the left and impulses from the left ear tend to draw both eyes to the right. Interference with the

normal functioning of the ears results in nystagmus. Barthels makes the statement that in rabbits ocular movements depend entirely upon stimuli from the ears, and section of the acoustic nerves produces complete loss of eye movements.

It is now definitely known that the ear consists of two organs of distinct and separate function. The cochlea, which is the organ of hearing, and the vestibular labyrinth, which is the sense organ of balance. The balancing portion of the ear consists of two tiny sacs known as the utricle and saccule, and of three semicircular canals. The utricle recognizes movements in an anteroposterior direction and the saccule of movements in a lateral direction. The semicircular canals detect rotary movement of the body in all planes.

The new ear tests consist of stimulation of these semicircular canals by either turning the patient in a chair, douching the ears with hot or cold water, or by the use of the galvanic current to the ears, producing a rhythmic nystagmus and vertigo; for example, turning the individual ten times to the right in twenty seconds, with the head upright, stimulating both horizontal semicircular canals, produces a horizontal nystagmus to the left, subjective sensation of turning to the left and "pass-pointing" to the right. (By pass-pointing is meant the inability to find, with the eyes closed, a spot which the finger has previously touched, the arm being kept stiffly extended, having been raised above the head and again lowered.) Turning in a chair produces these phenomena by mechanically causing a movement of the lymph in the canals. Douching with hot or cold water produces this circulation of the lymph by changing its specific gravity.

Based on a study of several hundred clinical cases and a considerable number of operations and autopsies, it is believed that the following are the pathways over which these stimuli are transmitted to the eyes to produce the nystagmus and to the cerebrum to produce the vertigo.

Drs. Langdon and Jones have brought out certain facts in regard to these pathways, some of them definite, others needing further analysis. Our present belief, in fact, is as follows:

1. The fibers from the horizontal semicircular canals pass through the VIII nerve, enter the brain-stem at the junction of the medulla oblongata and pons and continue directly to Deiters's nucleus and there divide into two pathways.

(*a*) The vestibuloöcular tract concerned in the production of the nystagmus. These fibers go from Deiters's nucleus to the posterior longitudinal bundle, through which they pass to the various eye-muscle nuclei, from which through the III and IV nerves they are distributed to the eye muscles themselves.

(*b*) The vestibulo-cerebello-cerebral tracts responsible for the vertigo. From Deiters's nucleus this path enters the cerebellum through the inferior cerebellar peduncles to the three vestibular cerebellar nuclei of the same side, from which it proceeds upward through the superior cerebellar peduncle and continues to the cerebral cortex from both sides, but more particularly the opposite side, through the crura cerebri. The cortical areas which receive these fibers are postulated by Mills to be in the posterior portion of the second temporal convolutions, adjacent to the cortical areas for hearing.

2. The fibers from the vertical semicircular canals have a very different course; after passing through the VIII nerve they immediately ascend into the pons and at a point above the middle of the pons they have a division into two pathways similar to the division of the horizontal canal fibers at Deiters's nucleus.

(*a*) The vestibuloöcular tract, the fibers entering the posterior longitudinal bundle, to be distributed to the eye muscle and finally to the eye muscles themselves.

(*b*) The vestibulo-cerebellar-cerebral tract reaches the cerebellum through the middle cerebellar peduncle, entering the cerebellar nuclei of the same side; from this point the pathway is identical to that of the fibers from the horizontal canal, through the superior cerebellar peduncle to the cerebral cortex of both sides.

The internal ear and these intracranial pathways constitute our conception of the "vestibular apparatus," and a knowledge of this is of use to the ophthalmologist in the study of ocular palsy and spontaneous nystagmus.

Epithelioma of the Eyelid and Cheek, Illustrating Two Methods of Cure and the Failure of the X-rays

Dr. G. Oram Ring exhibited a male patient, aged sixty-five years, from whose right lower lid he had removed an extensive epithelioma by ordinary surgical means, the denuded area having been covered by an epithelial graft from the forearm.

The operation was performed fifteen years ago. The grafts adhered perfectly and the lid remained normal in appearance until two months ago. The cicatricial ectropion now present is the outcome of a plaster treatment applied by a so-called "cancer doctor" to an epitheliomatous splotch on the cheek, which developed about eight years ago after the lid operation. The splotch referred to had been treated by an expert roentgenologist for several years, mainly by *x*-rays and for some months with radium, to no purpose. The plaster accomplished the eradication of the disease in two months when well-known forms of radiant energy had failed after several years of trial, but with an unfortunate cicatricial contraction of the lower lid.

The ingredients of the plaster were arsenic sulphur, eupatorium feniculoides, or dog fennel, and ranunculus, or crowfoot. The quantities and method of application were detailed.

Dr. Ring's purpose in presenting the case was not to advocate the use of the plaster, notwithstanding its merit, but to insist upon a less dogmatic adherence for so long a period to a method which had clearly failed.

A prompt and satisfactory result could have been accomplished, in Dr. Ring's judgment, by the application of the method of electrothermic desiccation, with which the profession in Philadelphia has been made familiar, especially by the work of Dr. W. L. Clark.

It was felt that the bloodless devitalization of malignant disease of the type referred to could be accomplished with promptness, certainty and precision by the desiccation method, thereby minimizing the cicatricial complication.

Dr. William L. Clark, in discussing the case, said he appreciated the compliment of the invitation to discuss the respective merits of the various methods practised for the treatment of epitheliomas. His experience covering a period of ten years had been such that he had formed well-defined conclusions upon the subject.

The methods considered were operative surgery, chemical caustics, thermocautery, Roentgen rays, radium, and the desiccation methods. The class of epitheliomas were confined to those of basal cell or rodent ulcer type, especially those appearing upon the eyelids and adjacent parts. The keynote of success, so far as permanency of cure is concerned, was the thorough destruction of the local lesion by whatever means employed by one treatment, for he considered it folly to allow any malignant tissue to remain after starting treatment, for there was danger of stimulation of the growth by so doing.

Nothing more was necessary in the class of epitheliomas under discussion, as they are of relatively low-grade malignancy, progress slowly, and seldom if ever metastasize. Another factor of importance, in addition, is the cosmetic result, and in choosing a method for the treatment of a given case the one that combines an equal chance of cure, together with a good cosmetic result, should be selected.

Operative surgery is efficient if performed radically, but the cosmetic result leaves much to be desired. Secondary plastic operations often improve this condition, but more often fail. Operative surgery has the added disadvantage of opening blood and lymph channels, favoring recurrence. The best argument against operative surgery in the treatment of these lesions is the fact that cases are being continually referred for other treatment by the highest exponents of the art of ophthalmic and general surgery.

The use of chemical caustics, such as nitrate of silver, phenol, etc., is most reprehensible, as they serve only to stimulate the growth. Pastes of arsenic or zinc chloride are often successful, however, when used by physicians experienced in their use; but

the results are by no means constant, and even in the hands of experienced men, failures are frequent. The reason for the failures can be readily seen. The depth of destruction cannot be accurately determined, and if one malignant cell is left remaining, recurrence is certain. The application is painful, there is danger of applying pastes on the eyelids, and there is frequent unnecessary scarring. When a good result was obtained it was a matter of luck.

Thermocautery is superficial in action, tends to stimulate the lesion and produces a contracted scar. Its use should be condemned. This applies either to the thermocautery or electrocautery.

The Roentgen rays are successful in a fair percentage of cases, and when they are successful the result is ideal, both from a curative and cosmetic stand-point. The results, however, are by no means constant, and from Dr. Clark's own experience and observations from the experience of the best roentgenotherapists he believed that there was a tendency to recur in a large percentage of cases sooner or later unless treated very early. It also has been observed that when the Roentgen rays are used to the limit and fail that the tissues are in worse condition than before treatment, and because of this lowered vitality, less amenable to other treatments. More than one *x*-ray treatment is usually required, and often the lesion is stimulated instead of retrogressing. There is also some danger to the eye in treating epithelioma of the lids.

The same objections apply to radium as to the *x*-rays, although often good results are obtained by them both.

The desiccation method is one which embraces the advantages of all and has none of the disadvantages of the methods mentioned. The *x*-rays and radium may, however, be used in some cases in conjunction with desiccation to advantage. It destroys the lesion thoroughly to any depth desired, and the control is so accurate that the smallest discernible point may be treated without danger, even on the cornea. Lesions may be destroyed with one treatment, blood and lymph channels are sealed at once, and there is no resultant contracted cicatrix. There is a minimal amount

of destruction of normal tissue. The percentage of recurrence computed from 150 cases of epithelioma of the eyelids, one year or more, is less than 3 per cent.

From a curative and cosmetic stand-point, Dr. Clark believed that there was no doubt but what the desiccation method is far superior to any method known at the present time for the treatment of basal-cell epitheliomas of the eyelids and adjacent parts.

NOVEMBER 15

Nodular Degeneration of the Cornea (Groenow)

Dr. William Zentmayer presented a patient who was a married woman of Polish birth. The history of the case was difficult to get, but it would seem that the vision began to fail soon after the birth of her first child, four years ago. She had a second child, about two years ago, and since then there has been a further, more rapid loss of vision. No knowledge of injury or severe inflammatory symptoms.

In the right eye there was an irregular horizontal sigmoid opacity, measuring 1.5 by 4 mm. in the center of the cornea. This was surrounded by many small round or nearly round dots, measuring about 0.5 mm. in diameter, arranged in an irregular circle about the larger opacity. The intervening spaces and the rest of the cornea were studded with pin-point opacities. The location of the opacities was subepithelial, but only in one or two places was the epithelium distinctly elevated. In the left eye the opacities were of a more uniform size, and there was a distinct tendency to whorl arrangement. Their color was a dark gray.

In both eyes the retinal vessels, especially the veins, were distinctly engorged. There were no external signs of congestion.

The Wassermann test made last spring in the service of Dr. Chance, and recently again in Dr. Zentmayer's service, was negative. The von Pirquet was slightly positive. There was nothing relative in the family history.

Historical Sketch

Dr. S. D. Risley presented a valuable and interesting historical review of the "Rise and Progress of Ophthalmology in Philadelphia." This paper does not lend itself to abstraction, and since it will be published in full in an early number of the *American Journal of Ophthalmology* and also in the *Transactions of the College of Physicians of Philadelphia*, no attempt to review it will be made at this time.

Injury to the Eyes from Lightning Stroke. Report of Two Cases

Dr. William Campbell Posey reported two cases, one that of a lad who was struck while leaning against the chimney of a cabin, provided with an iron stack. He was hurled to the ground and remained unconscious for several days. The forehead over the right eye was burned and the right eye itself much injected. Dr. J. A. Spalding, of Portland, who saw him forty-eight hours after the injury, found the lids swollen and the conjunctiva much congested, diffuse haze of retina and a faint haze in the posterior part of the lens. The signs of injection rapidly diminished, but the haze of the lens gradually increased until it became entirely cataractous. Dr. Posey had the case under observation for several months, and finally did a cautious needling, as all signs of irritation were absent.

The second case also occurred in a young man who was blinded by a lightning flash while looking out of a second-story window during a thunder storm. Both eyes were injected and lids swollen. A diffuse haze of the retina also supervened and both eyes were almost totally blind for several weeks. Full vision was recovered, however, in several months' time, no trace of the accident being discernible at the expiration of that time.

Dr. Posey said he had found about 50 cases of injury to the eyes after lightning stroke in the literature. Injury to the lens was the most common sequel, the opacities ranging from localized dots to

complete haze of the lens. The most satisfactory theory to account for the charges in the lens in this class of cases is that of Hess, who proved by experiment that the electric discharge has the power to kill living cells without the development of heat, and that the epithelium of the lens capsule is made to die in consequence of such discharges, the result being a clouding of the lens. Dr. Posey referred to other lesions which have been reported after lightning stroke, such as neuritis and optic atrophy, rupture of the choroid and detachment of the retina, retinal hemorrhages, opacities of the cornea, pupillary changes, etc. In view of these facts, Dr. Posey thought that no operation should be undertaken until all signs of uveal irritation had subsided, and only in the presence of a full field; even then the prognosis should be guarded. He preferred cautious needling in this class of cases rather than any attempt to remove the lens at one sitting.

Bilateral Coloboma of the Lid

Dr. William Campbell Posey presented a case of bilateral coloboma of the lower lid associated with malformation of both superior maxillary bones. The defect in the right eye had been corrected by sewing together the edges of the coloboma. In the left eye, however, the coloboma had involved practically the entire inner half of the lid. The gap was filled in with a flap taken from the root of the nose. An associated pulling up of the right side of the mouth had been corrected by a plastic operation by Dr. J. B. Roberts.

A Case of Epicanthus

Dr. Posey showed 2 cases of a curious elongation of the inner halves of the upper and lower lids of both eyes in Italian children, associated with other signs of retarded physical development, small upper extremities, deafness, malformation of the skulls, etc. Dr. Posey had operated on the older child, removing the

right lacrimal sac, which was the seat of an abscess, and prolonging the palpebral fissure inward by notching the webb-like fold of skin which united the lids in that position.

Synchronous Movements of Lid and Jaw

Dr. Posey showed a case of synchronous movements of the upper lid and jaw of the right eye associated with divergence of the same. The lid had been raised by a Hunt-Tansley operation and the internal rectus advanced. The ptosis being only partially corrected as a result of the first operation, a Hess procedure had been done later. The cosmetic result is now good.

Results of an Operation for Mucocele of Frontal and Ethmoidal Cells

Dr. Posey also exhibited a case showing excellent cosmetic and visual results a year after operation on a case of extensive mucocele of the frontal and ethmoidal cells.

Superficial Punctate Keratitis

Dr. Sidney L. Olsho, by invitation, presented a patient, P. L., white, carpenter, aged twenty-two years, who showed numerous typical punctate opacities restricted to the central portions of both corneæ and without any other signs of inflammation.

The disease was of four years' standing and seemed not to yield to treatment. The symptoms fluctuated in intensity and at times were almost absent.

The patient was in robust health, but had a quiescent infiltration at the right apex. The upper respiratory tract was normal excepting for a slight deviation of the septum.

Two of his three brothers and one of his six sisters had psoriasis.

Dr. Zentmayer said that one point of interest in Dr. Olsho's case was its persistence, as in the several cases he had seen it had run a course of a few weeks or months. In nearly every instance

there had been present, or there was a recent history of, a catarrh of the upper respiratory tract. He had found holocaine to be of value.

He asked whether the collection of the leukocyte or of lymphoid cells was not also a finding in ordinary phlyctenular keratitis, which at present, at least, was not considered of neuropathic origin?

DECEMBER 7

Intracranial Complications of Aural Diseases in Relation to Ophthalmology

Dr. S. MacCuen Smith said that ocular manifestations are frequently unreliable on account of their absence in most rapidly progressing cases, sufficient time for their development not elapsing between the onset of the disease and its fatal termination. Optic neuritis, while a fairly constant symptom, is mainly due to intracranial pressure, and therefore not characteristic, necessarily, of aural diseases and their complications alone, but may also be found in brain tumor, etc.

Ocular symptoms would seem to offer definite indications that the aural disease has involved tissues within the cranial walls, this being about the limit of their significance. The absence of ocular symptoms, on the other hand, does not exclude the presence of intracranial suppuration. Given other characteristic symptoms, a negative ophthalmoscopic examination has absolutely no significance.

Optic neuritis in sinus thrombosis occurs too late to be of early diagnostic value, but will be present in about 50 per cent. of the more advanced cases.

In brain abscess there are no intra-ocular symptoms that definitely define its location. Symptoms which indicate the presence of this lesion, but not its location, are photophobia, external strabismus due to pressure on the motor oculi, or nystagmus and

dilated pupils if the abscess is large; while if small, the pupils are small and sluggish. This being true, neuritis occurs late when pressure is exerted through abscess in the temporosphenoidal lobe, but is earlier in development and more constant in abscess of the cerebellum.

In temporosphenoidal abscess of the left side, aphasia is present, as well as optic amnesia and optic neuritis if the abscess is sufficiently large to produce pressure.

In cerebellar abscess, nystagmus is common and optic neuritis is more constant than in temporosphenoidal abscess. Nystagmus will usually be found directed toward the affected side, becoming more marked as the disease progresses.

Cerebral irritation is a prominent symptom during the initial stage of meningitis; also photophobia and contraction of pupils. Later, as compression symptoms develop, the pupils react sluggishly and finally become dilated, often unequal and may be firmly fixed. At this late stage symptoms of cerebral paralysis become increasingly marked, together with ptosis, strabismus, nystagmus or conjugate deviation. Diplopia has been such a constant and marked symptom in the writer's personal experience that he looks upon it as being of considerable importance, and he is always suspicious of a developing meningitis when a patient suffering from aural disease complains of a progressive intolerance to light.

Dr. Howard F. Hansell in discussing Dr. Smith's paper said: Diseases of the eyes in their relation to diseases of the ear as a subject of study has received scant attention until the importance of the tests for balance or equilibrium became manifest. The status develops by the Bárány test, both physiological and pathological, of the relation between the ear and the eye is striking and impressive. Without indicating disease of either organ in the subject of the test it demonstrates the presence or absence of a lesion of the connecting fibers or the cortex of the brain, its location and its approximate size—a long step forward in the diagnosis of intracranial affections.

Papillitis and muscular paralysis are the usual ocular complications of otitic meningitis, the former due to involvement of the

sheath of the optic nerve, and secondarily the nerve itself, by direct extension of the inflammation and the latter to pressure by the products of the inflammation on the sixth, fourth and third nerve, in the order given, in their course at the base or at the entrance into the orbit.

A second class of cases of ocular involvement includes those in which a clot or thrombus originating in otitic inflammation lodges in the lateral or cavernous sinus. The optic disk is covered by exudation and hemorrhages. The retinal veins are enormously dilated and tortuous and the retina infiltrated by numerous deep and superficial hemorrhages. Diseases of the ear and temporal bone are responsible for two-thirds of the cases by reason of direct contact, by meningitis and by brain tuberculosis.

Another set of cases are those in which labyrinthine disease is the cause of some forms of nystagmus exclusive of nystagmus of miners or of opacities in the media. Bárány has clearly shown that physiological nystagmus is created by a current in the horizontal canals. His tests have led to the knowledge that diseases of the labyrinth, or of that part of the brain connecting the labyrinth with the nuclei of the external eye muscles, becomes the cause for the nystagmus.

That diseases of the eye may produce organic changes in the ear leading to deafness has not been established. The only indication that such a connection may possibly exist is the deafness associated with sympathetic ophthalmia.

It has been suggested that this reflex movement has its origin from unusual impulses arising from the labyrinth.

Transmission of disease from the ear to the eye is always serious and often fatal because of the complex channel of communication. It is never direct or immediate as is the case in extension of disease from the sinuses adjacent to the orbit. The germ or exciting cause travels through veins or lymph canals, through the membranes or tissues of the brain and seldom through continuity of structure. Therefore ocular complications may be referred to cerebral rather than to otitic causes.

Ocular Signs and Symptoms Associated with Intranasal Lesions

Dr. S. Lewis Ziegler stated that only within recent years had the interrelation of ocular and nasal lesions been accepted as important factors in the evolution of modern medicine. He considered it important that the rhinologist and ophthalmologist should join hands in a coöperative effort to recognize and correct these obscure lesions. The transmission of disease may occur through direct infection, through the toxins of suppuration, through continuity of tissue, through edema from pressure in the orbit and through lymphoneuroses which are purely reflex.

Dr. Ziegler reviewed in some detail the affections of the orbit, ocular pareses, optic nerve lesions, intra-ocular manifestations, lacrimonasal disease, headache and reflex neuroses which arise from intranasal and accessory sinus disease. The reflex neuroses arising from intranasal lesions were of special interest to the writer and he thought the three most active etiological factors were: (1) Pressure contact, (2) hyperesthesia and (3) nasal obstruction.

Dr. Ziegler thought that the most interesting part of this whole problem was the study of these reflex manifestations and concluded by asking, "Why should intranasal pressure originate a severe bulbar or supra-orbital neuralgia? Why should sinus disease cause a fugitive edema and ecchymosis of the upper lid as in a case related by de Schweinitz? Why should boggy contact-pressure in the nose of an undernourished child cause blepharospasm, photophobia, corneal ulcer, scalp sweating and universal skin leakage? Or in such a case why can we reverse the reflex by opening the child's eyes and thus cause it to sneeze? Why does a non-suppurative nasal lesion cause choroiditis, as improvement through nasal treatment has demonstrated? Or why, as in Dunn's case, does a chronic choroiditis recover when a shrunken fibroid appendix is removed? In other words, will not a careful study of the chemistry of metabolism show us how a terminal sympathetic filament controls a local lymph secretion, whether it be physiological from a normal reflex or pathological from a

perverted reflex? Would we not therefore gain much profitable information by a closer study of lymphoneuroses originated by reflex impulses?"

Ocular Lesions the Result of Oral and Pharyngeal Diseases

Dr. William Zentmayer stated that the dental lesions may be considered under two groups—Reflex and Inflammations from infections.

The ocular conditions which have been attributed to reflex dental cause are: spasm of accommodation, restriction or paralysis of accommodation, spasm of the orbicularis, heterophoria, amblyopia and asthenopia without ophthalmoscopic evidence (Brunner); glaucoma (Priestly Smith). In Dutrow's case an impacted tooth gave rise to ocular palsies and contractures. Both normal and complicated dentition may give rise to ocular symptoms keratoiritis, spasmodic contracture of the facial muscle, conjunctivitis and lacrimation. Foreign bodies in the teeth and traumatism of the alveolar-dental ligament have been respectively associated with retrobulbar pain and temporary amblyopia.

Oral Sepsis. Considering the wide prevalence of amebic disease of the mouth, the generation of endotoxins by the ameba present and the virulence of the organisms found in the apical abscess, the comparative infrequency of distant infection can only be explained by a high resistance in the system developed by their long-continued presence.

Iridocyclitis, iritis, episcleritis, keratitis, persistent conjunctivitis, choroiditis, herpetic keratitis, may be of septic oral origin. The sepsis may have an exogenous transmission, as in Black's case in which conjunctivitis was produced by the patient carrying the pus from an abscessed tooth into the conjunctival sac by the finger. Conjunctivitis has been induced by the foreign soldiers by the introduction into the sac of tartar scraped from the teeth.

Tonsils. That the tonsils have not more often been found to be the seat of the infection is surprising when we consider how fre-

quently they are blamed for general infections. Cases of iritis, paralysis of accommodation and of the iris of this etiology are reported.

Pharynx. Schmelsky finds a causal relationship between follicular pharyngitis, follicular conjunctivitis and trachoma. Unhygienic condition of the pharynx is considered by Allen and others as a cause of phlyctenulosis. May finds that adenoids in children may be associated with blepharitis, dacryocystitis, congestion of the conjunctiva, phlyctenulosis and a form of conjunctivitis resembling trachoma and that they predispose or cause these conditions by congestion of neighboring parts. Posey's case of exophthalmos due to adenoids may be similarly explained. Adams has seen hyperemia and disturbance of the choroid relieved by the removal of adenoid hypertrophies.

Postoperative Complications. Continuance of ciliary congestion and gelatinous iritis more particularly after cataract extraction have been seen to subside after the removal of an abscessed tooth. Fox has seen postoperative suppuration controlled by treatment of a dental lesion. Francis saw infection after cataract operation coincident with the development of tonsillitis.

Ocular Symptoms Enveloping after Tooth Extraction. Gutman saw bilateral exophthalmos and death from purulent meningitis, and also death from thrombosis of the cavernous sinus, and postneuritic atrophy follow extraction of an upper molar tooth in each instance.

Route of Irritation and Infection. According to Black reflex trouble arises from irritation of vital pulp and is usually of thermic origin or from a foreign substance. Pressure upon terminal branches of the fifth nerve within the pulp cavity excites the reflex. The route of infection is either directly into the blood and lymph streams or by extension of septic processes either by way of the mucous membrane or periosteum. It will be seen that the type of ocular inflammation which most often is attributed to focal infection is uveitis. But the structures involved are those which are particularly susceptible to the toxemia of the Bacillus tuberculosis and the Spirocheta pallida, and as Marple has stated,

there are no distinguishing peculiarities about a uveitis from focal infection. It is needless to say that the mere presence of an abscessed tooth or pyorrhea proves nothing. Here as elsewhere must other possible causes be eliminated, but even in their presence it must be demonstrated that treatment directed toward their removal failed, whereas the removal of the supposed source of infection alone brought cure. As Herman Knapp once said, "We cannot reach a satisfactory conclusion on any subject until its boom has subsided," and in relation to this subject that period has not yet been reached.

Dr. Charles P. Grayson thought that Dr. Zentmayer had displayed a great deal of both discrimination and industry in the preparation of his paper. The field that he covered is one of comparatively recent opening, yet he has combed the literature so critically and thoroughly that his paper is one of exceptional clinical interest. It seems to Dr. Grayson still questionable whether any pathological condition within the mouth or mesopharynx can exert a *direct* disturbing influence upon the eye. None, of course, doubt that the focal infections so frequently traced to the teeth and tonsils can occasion such serious systemic disorder that the eyes may share in the general disturbance, but this is obviously indirect and is not at all analogous to an ocular injury that ensues, for instance, upon disease of the nasal accessory sinuses. If the eyes suffer at all from the general bacteremia occasioned by alveolar abscesses or cryptic suppuration of the tonsils, it is probably in most cases a late manifestation and has been preceded by a number of other lesions that have already directed attention to the source of trouble. If there be any direct pathological connection between the mouth and oropharynx and the eye, it certainly has not yet been clearly demonstrated and Dr. Grayson is inclined to doubt that it will be.

Obstructive Lacrimonasal Disease and its Treatment

Dr. E. B. Gleason stated that infection of the duct may occur either from the conjunctiva or the nasal mucous membrane and

the reason why this does not happen more frequently is due to the small size of the puncta and the presence of the valve of Hasner. The nasal orifice of the duct is in the suture of the inferior turbinate with the superior maxillary at the junction of the anterior fourth with the posterior three-fourths of the turbinate at the apex of a broad inverted V, the line of suture descending somewhat abruptly in front and more nearly horizontally behind; so that the valve of Hasner is easily located by passing a probe from behind forward beneath the inferior turbinate until the end of the probe sinks into the apex of the V described above. In the same way a tube may be inserted into the duct so as to cleanse it by injecting fluid from below through the duct, sac and puncta. The nasal orifice of the duct can be inspected in most instances by infracting the inferior turbinate with Sullivan's modification of Killian's speculum. This procedure is usually done to expose the nasal wall of the antrum so that a sufficient portion can be curetted away under direct vision to thoroughly open the antrum. The procedure can be repeated as ordinary office visits as often as thought necessary without great reaction so far as the inferior turbinate is concerned.

The most annoying symptom in mild cases of catarrh of the duct is epiphora. Generally the obstruction to the flow of tears is either where the inferior canaliculus enters the sac or at the nasal orifice of the duct. If the obstruction is at the canaliculus, the treatment is astringent collyra, dilation or slitting open the canaliculus. When the obstruction is at the nasal orifice, the treatment is intranasal. Cases where epiphora occurs only when the patient is exposed to cold yield to applications of iodin—potassium iodide —glycerin or 10 per cent. argyrol beneath the inferior turbinate body to the region about the nasal orifice of the duct. Because of the close proximity of the wall of the nose and middle turbinate, there is sometimes a capillary attraction that retains the solutions in contact with the parts for a considerable time. Treatment should be directed when necessary to reducing the size of the inferior turbinate with scissors, snare or galvanocautery or changing its relation to the nasal wall by infracting it toward the septum.

The more severe cases of infection of the sac with retention of pus with or without a fistula are not very satisfactory to treat. However, the majority of oculists seem to think that better results are obtained by passing probes, wearing styles, etc., than by intranasal operations. In one case seen by the writer ten or more years ago where there was complete bony occlusion of the nasal orifice of the duct and a fistula, he laid the fistula open into the sac and introduced a small nasal trephine into the sac as low down as possible and removed a small disk of tissue into the nose. He then turned into the nose through the opening a thin strip of skin from the lower lid and stitched up the wound. The operation was simple and easy and was reported a year or more afterward as having been successful in bringing about a cure of the fistula and relieving the epiphora.

Purulent dacryocystitis may progress to bony occlusion of the duct with fistula beneath the inner canthus. The conjunctiva may be infected from the pus and ulcers form on the cornea; but although theoretically a suppurating sac is a focus of infection comparable to chronic alveolar abscess, suppurating tonsils, etc., the deeper structures of the eye are probably never infected from this source except through a wound.

Dr. Posey discussing Dr. Gleason's paper said that the cause of a watery eye is not always intranasal, for it may depend upon a number of factors connected with the eye. Thus, increase in lacrimation is symptomatic of nearly all inflammatory conditions of the eye. Again, certain conformations of the skull which occasion abnormally small lacrimonasal ducts predispose to it. Anything which interferes with the delicate suction-like action by which the tears are sucked up from the globe and conveyed into the lacrimonasal sac is also a causal factor. Certain innervational disturbances in the supply of the orbicularis muscle and relaxation of the internal palpebral ligament, will occasion this. Dr. Posey said his plan of procedure in the treatment of diseases of the excretory operation of the lacrimal apparatus is as follows: If there is simply increased lacrimation without any apparent local cause to occasion it, the punctum is dilated and the sac and duct

washed out with a solution of boracic acid, zinc or alum. Stronger astringents are never used, on account of the danger of their escaping into the soft tissues of the orbit and causing orbital cellulitis. Dr. Posey referred to a case seen in the practice of another where vision was lost from orbital cellulitis occasioned by the escape of a solution of silver nitrate into the orbit during the act of syringing; inflammation of the optic nerve followed by atrophy resulting. If repeated syringing fails, he then introduces a style, as he does not think the repeated passage of probes is warranted, on account of the pain which this procedure gives rise to and the doubtful results. Care must be taken that the operator should conform the length of the style to the apparent length of the duct before operation, and the right-angled shank should be made to fit nicely into the divided canaliculus, to prevent subsequent healing and closure of this tubule and to provide for drainage. The style is removed at the end of three or four months. If lacrimation still persists, the extirpation of the sac is advised.

Acute Dacryocystitis. After the administration of a general anesthetic, gas in many instances, the lower canaliculus is expressed by pressure on the swollen lid, and a style inserted after the manner just described. This one operation gives exit to the pus, overcomes the stricture and provides drainage at the same time, and is much to be preferred in Dr. Posey's judgment to the old method of incising the sac from without and later overcoming the stricture by probing. He had operated on all cases of acute dacryocystitis in adults by this plan for many years and never had one untoward result.

Lacrimal Stricture with Catarrhal Discharge. Syringing with astringent washes and the instillation of a 1 or 2 per cent. solution of ethylhydrocuprein into the conjunctival cul-de-sac several times daily was his usual procedure. The administration of the latter solution is in most cases purely empirical, and he had found it highly efficacious in many cases of catarrh of the sac in which pneumococci are not found. Failure after two or three weeks of this treatment is followed by extirpation of the sac.

Mucocele of the Sac, with Tightly Enclosed Contents. Extirpation of the sac is advised in all such cases.

Extirpation of the Lacrimal Sac. The indications for the removal of the sac have been given. The method Dr. Posey employed was that outlined by Meller, and the success of the operation depends upon a strict adherence to his technic. The first essential is the control of pain and bleeding by a free use of novocain and adrenalin. Dr. Posey applies nine parts of a 2 per cent. solution of the former to one part of a 1 to 2000 solution of the latter. The Pravaz syringe recommended by Meller is clumsy and provided with too large a needle. The ordinary hypodermic needle suffices. He usually empties the contents of one barrel just under the skin, one-half below and the other half above the canthal ligament. The contents of the second barrel are injected into the deeper tissues above and below the ligament. Care should be exercised to avoid injuring the walls of the sac with the needle. After incising the superficial tissues, and parting the lips of the wound with Meller's speculum, the sharp teeth of which Dr. Posey had replaced by dull ones, to avoid possible injury to the cornea in case of slipping, he searched carefully for the internal palpebral ligament, as he had found this the most valuable landmark in the operation. The ligament once found, the position of the sac just below it is readily ascertained, and it becomes a simple matter to divide the ligament and to separate the inner wall of the sac from the bony margin of the orbit by the points of a closed pair of scissors. More difficult is the separation of the outer wall of the sac, on account of the danger of getting into the orbital fat and obscuring the field of operation. After freeing the lateral portions of the sac, the sac is pulled forward by a stout pair of forceps and the duct divided as far down in the canal as possible. The division of the apex of the sac is left until the last, as the few rapid cuts of the scissors necessary to accomplish this are often followed by considerable hemorrhage. After curetting the lacrimonasal duct, the lower canaliculus invariably should be slit up and curetted throughout its entire length, to destroy its mucous lining, and to obviate leaving any possible focus of infection. Healing is prompt, and in but one case, where a keloid overgrowth marred the cosmetic result, had there been any appreciable scarring. He had done the operation a

great many times and found it one of the most satisfactory in eye surgery.

Dr. S. D. Risley, invited to speak, said he had been deeply interested and instructed by the thoughtful papers presented in the symposium provided by the Committee. His own experience was quite in accord with most of the views which had been expressed both in the papers and the discussion; but he thought that additional emphasis should be given to two features, bearing, primarily, (1) upon the etiology of the group of affections under discussion and (2) upon their treatment. He thought that the importance of anatomical deformities in the anterior segment of the skull was often overlooked. Many years ago he had observed the frequent association of ocular defects with these variations in the form of the skull and had secured a large collection of *hatters' forms* for patients with high degrees of asymmetrical astigmatism, and with muscular imbalance and had been impressed by the often grotesque shape of the head in these cases. Not only was the cranial dome distorted but there was great deviation in the face. A relatively flat or even concave zygoma on one side and a large convex one on the opposite side, and the eye on one side being nearer the median line of the face on one side than on the other. It is obvious that these deviations would affect the walls of the orbits and cause more or less variation in the location of the eye in the orbit and the form of the eyeballs and also of the distribution of the extra-ocular muscles; not only in their origin at the apex but in their length, line of direction and their point of attachment to the eyeballs. He thought that these abnormal conditions were in a large measure responsible for the defects of refraction in the eye, through a change in the diameters of the face, and also for many of the abnormalities of binocular balance. He had been impressed by their frequent association. But not only were the orbits involved in these anatomical anomalies, but also the nasal fossæ and the mucous-lined bony sinuses contiguous to the orbits, and the lacrimal duct, all of which drain into the nose and pharynx. Any change from their normal relations is significant not alone for the reason that it may disturb their normal

drainage, but renders them peculiarly liable to disturbance from any systemic disease affecting the mucous membranes. This was a second point which he wished to emphasize. The mucous membrane lining all these cavities in the anterior segment of the skull, the conjunctiva with its lacrimal drainage system, and the ear with its Eustachian tube included, are particularly susceptible to many systemic disorders. The ectoderm, he thought, seemed the first to disclose the presence of toxic or infectious systemic states. A good illustration, he thought, was found in the so-called common cold, with the stuffed nose and ears, increased lacrimation, frontal pain and general malaise. The conjunctiva remained transparent but was edematous and the ophthalmoscope revealed a hazy, fluffy fundus. The same conditions were often found after attacks of acute indigestion, or with prolonged or habitual constipation, as a result of the ensuing toxic conditions. There was probably present in all of these systemic conditions a general acidosis of the tissues; certainly professional experience had for many years approved the administrations of the alkaline earths as a therapeutic measure.

He had so frequently seen this toxic syndrome clear up under alkaline treatment and attention to the alimentary tract that he esteemed such measures as important before any radical operative interference was undertaken.

Dr. Holloway stated that he was very glad to hear Dr. Zentmayer make the statement he did in regard to dental infection. While he had no doubt these were all too frequently responsible for ocular conditions, we should not lose sight of the other etiological factors and the present vogue for focal infections. Some years ago we went through the cycle of the accessory sinuses, then the ductus glands, and we are now in the cycle of dental infections. The fact that many of these symptoms or diseases that have been enumerated may be caused by a dozen different factors should lead to an exhaustive study of the patient. Not infrequently two or more affections have been found and the difficulty is to determine which is really the exciting cause.

Concerning the dacryocystitis cases, Dr. Holloway stated that

he had very good results in using mercurophen as an irrigating fluid. Mercurophen is the new mercurial preparation made at the Dermatological Research Laboratories of the Polyclinic Hospital by Drs. Schamberg, Kolmer and Raiziss.

The first case in which Dr. Holloway had had occasion to use this the dacryocystitis was associated with mature cataract. Pure pneumococcus cultures were recovered from the conjunctiva, but after slitting up the duct, free irrigation of the eyes and irrigation of the sac and duct with mercurophen, negative cultures were obtained at the end of a week. He had also obtained splendid results with this preparation in the treatment of acute conjunctivitis.

J. Milton Griscom, M.D.,
Clerk.

PROCEEDINGS

OF THE

SECTION ON OTOLOGY AND LARYNGOLOGY

JANUARY TO DECEMBER

Transplantation of Tibia for Nasal Deformity

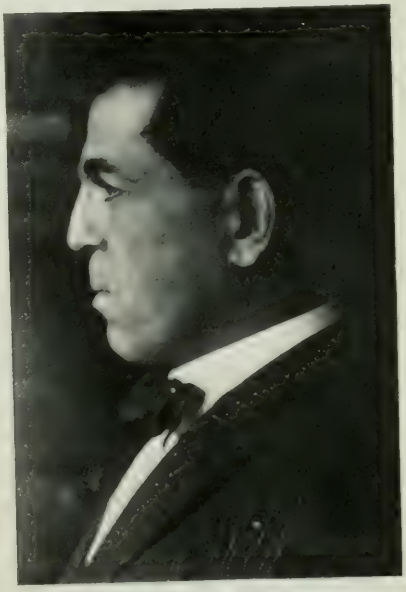
BY NATHAN P. STAUFFER, M.D.

The physical and mental discomfort of a nasal disfigurement is not the only hardship of patients who have had traumatic injuries of the face. Whenever such a patient endeavors to secure employment his or her appearance militates against their engagement. The surgeon here has a decided field of usefulness, and the works of Carter and Roe, of America, and of Josephs, of Berlin, have been of distinct advantage and relief to a class of patients heretofore almost neglected. As previously noted in my article in the *Laryngoscope*, the submucous operation will cure many slight deviations of the nose, especially those of the tip. The depressed fractures, however, need a more extensive operation with some heavy material to replace the lost bone support. The use of paraffin for a while seemed to fill this need, but later reports did not give the result one would desire, so that the bone transplant found a new and waiting field. The former method of using a resected rib to make the bridge caused some difficulties and dangers, such as pleurisy and pneumonia. The idea of the front surface of the tibia offered a better solution because of the lessened risks and the shorter convalescence and lessened pain after the operation. During the Clinical Congress of Surgeons in Philadelphia, in October, 1916, I remade a patient's nose, and herewith show the photographs, as many of the surgeons were anxious to see the after-results. The patient, Salvadore Pecella, Italian, aged thirty-four years, married,

Obstructed nares; unable to get air through either nostril; flat nose. Before operation, 1912.

Tibia transplanted, giving straight nose. After operation, December 23, 1916.

Saddle nose caused by traumatism. Before operation, 1912.



Note straight line of corrected nose. After operation, Dec. 23, 1916.

Transplantation of the Tibia for Nasal Deformity.

with two children. Occupation: sailor and barber. While acting as an enlisted sailor in the United States Navy he engaged in boxing matches and had his nose fractured several times. He first consulted me two years ago to have the obstruction in his nares removed, as he was unable to get any air through either nostril. Under local anesthesia I did a submucous resection with great difficulty, as both nares were completely closed by the quadrilateral cartilage. I found it necessary to take out every portion of the septal cartilage, for it was bent at such a sharp angle; any remaining cartilage would have held the mucous membrane across the vestibules by its sharp angles. I found the layers of the cartilage had been split by the blows upon his nose, for after the front obstruction was removed I discovered a piece of this cartilage driven back alongside of the perpendicular plate of the ethmoid. Following this operation he obtained such marked relief in breathing he disappeared. Upon his seeking a new position lately he found his facial disfigurement was very much against his securing work anywhere, so he recalled my desire to rebuild his nose, and returned requesting relief.

The operation was done in the Presbyterian Hospital, October, 1916, ether being given by Miss Strang. The face was prepared with soap and water and alcohol the night before and a moist bichloride dressing was placed over the nose. At operation the face was again prepared. Two operators, Drs. Jopson and Stauffer, two assistants, Drs. Hunter and Murphy, were used so that time would be saved and the two operating on the leg would not handle the nose. The incision is a curvilinear one between eyebrows convexity down. Periosteum is cut higher up than skin incision and loosened above and then turned back off of nose on the bridge below. I dissected the skin over the nose by Freer's septal dissectors from an incision just below the glabella (where the bridge of the spectacles rests) and inserted piece of tibial bone $1\frac{3}{4}$ inches long by $\frac{3}{8}$ of an inch wide and $\frac{1}{4}$ inch thick, which was skilfully chiselled out by Dr. John H. Jopson while I was preparing the bed in the nose for the bone transplant. This bone transplant is slipped under the skin to the tip of the nose and the upper end inserted under the upper portion of the periosteum of the fore-

head and the periosteum of transplant sewed fast to the periosteum of the forehead. The skin is closed with fine horsehair stitches and a gauze padding is placed over the nose and sides to protect it from injury while the patient is recovering consciousness. The first day the skin over the whole nose looked purple. Two days later the nose looked very red over the bridge where the transplant was causing pressure, and the following day two pimples appeared at this spot, but no further complications arose and he made a perfect recovery except for a sore leg which made him lame for about ten days.

My reason for using the tibia is that in several cases I have seen the lung punctured in using a rib resection and known of one death, and this danger is offset by using the tibia. In using the tibia you get a stronger piece of bone, and I would advise against much thinning as some do in the rib resection; the thicker bone will hold up the nose better, and as this patient stated, "I get more air through my nose since you put the new bone in."

That it is a useful operation you can see by comparing the photographs before and after operation. His actions on January 1, 1917, will prove that it will stand hard usage. In a fight my patient received a pair of black eyes and several hard punches on his nose. The lump on the right side of his nose received in this pugilistic encounter has not entirely subsided, and the nose is still swollen; but what is stranger still is that the nose shows that the bone graft was able to withstand the strain of a rough-and-tumble fist fight.

In making this graft the important points are to get the periosteum of the bone graft sewed fast to the periosteum of the forehead under which you insert the graft; to put the periosteum next to the skin so as to prevent the formation of new bone; and to have the piece long and wide and strong enough. The most difficult part is getting the skin dissected off the bridge of the nose, especially where the perpendicular plate joins the cartilage, as you are apt to puncture the mucous membrane into the nasal chambers, thereby making an open wound into which the transplanted bone will slip, protruding into the nares. This can be overcome by keeping the dissector and later the transplant close to the skin, and not to hurry during the operation.

PROCEEDINGS

OF THE

SECTION ON GENERAL MEDICINE

JANUARY TO DECEMBER

The Dust Hazard in Certain Industries

BY T. GRIER MILLER, M.D., and H. F. SMYTH, M.D.

Dr. Miller: Dust samples were collected directly from the air at the respiration level in 65 departments of nine separate industries, five handling inorganic and four organic materials. The method recently devised by Palmer, of the New York State Commission on Ventilation, was employed in the work. By our studies we determined the dustiness of the industries, judged by the weight of the dust and the number of its particles, the percentage distribution of the particles according to their size, and most important of all the inorganic content of the dusts. Our studies justify the following conclusions:

1. For a complete understanding of the dust problem in industry there must be considered not only its weight but the number of the particles, whether they are organic or inorganic, and their percentage distribution according to size.

2. The order of the industries studied in regard to dustiness as determined by weight was: Portland cement, plush, carpet, blanket, flint-grinding, steel-grinding, asbestos, felt hat, pottery, cigar and silk.

3. The order as determined by count of the particles was the same except that the asbestos, plush, carpet, blanket and the felt hat industries were given lower positions. This was due largely to fibers in these dusts which it was impossible to include in the counts.

4. The so-called organic dusts were invariably composed of both organic and inorganic materials, and the latter ingredient may account for the harmful influences which have been attributed to certain of these dusts.

5. The organic dusts averaged less both in weight and in count than the inorganic dusts.

6. The percentage distribution of the different-sized particles was curiously similar in all the samples, and it may be assumed that slightly more than half of all dust particles countable by the method employed are about 1 micron in greatest diameter, the others ranging up to 40 microns.

7. Dust removal at the point of production not only greatly decreases air dustiness but removes the smaller particles.

8. The substitution of wet processes for dry ones effectively lessens air dustiness.

9. Air dustiness varies inversely with relative atmospheric humidity, as does also the percentage of the larger dust particles.

Dr. H. R. M. Landis: I have had the good fortune to be associated with Dr. Miller in this work, which, so far as I know, is the first thoroughly scientific study made of the subject. Two centuries ago attention was called to the deleterious effects of dust. The difficulty in connection with the study is that all dusts are considered equally bad. Within the last few decades they have been regarded as extremely likely to produce pulmonary tuberculosis. Pathological proof is lacking that organic dust produces any lesion. The work of Dr. Pancoast with the *x*-rays is one of the most valuable contributions to the question of pulmonary radiology. The *x*-rays will never make an etiological diagnosis of tuberculosis—will never prove that the early changes are due to one of any number of different causes. In the study of pneumo-

coniosis alone I feel that the development of röntgenology has been distinctly well worth while. In this disease the *x*-ray plates to the casual observer would seem to show tuberculosis, but the experienced man in röntgenology will know that he has not tuberculosis to deal with. The stout man shown on the screen was under my care six years ago and weighed 130 pounds. Some time later a lesion appeared on the left side coming well down. Despite my advice against his return to his occupation he went back, remained well and his weight ran up to 208 pounds. He has been working steadily under the same conditions for the last five years. The lesion is apparently completely arrested, the only evidence of it being a fibrosis. The presence of fibrosis is not surprising when one remembers how tuberculosis is cured. In so far as fibroid tissue develops in the lung, so far will the disease recede. Klotz in his study of anthracosis says that one of the characteristic features of the pathology in addition to the fibroid change is the blocking of the capillary lymphatics, making the subjects more susceptible to pneumonia. I think the prevailing opinion among men interested in industrial medicine is that in so far as organic dust is concerned in the production of disease of the lungs *per se* it may be disregarded. The slides shown tonight emphasize the large influence of the diaphragm in respiration. While this is well known, little mention is made of it in the text-books. We have been taught that the dyspnea of tuberculosis is due to involvement of a large amount of lung tissue. I have learned that the dyspnea may be present without such involvement. Men will say that the death rate in tobacco workers leads all others. We know, however, that cigars cannot be made except in a damp condition. It is an extraordinary thing that some of the dust causing damage does not do so except after many years of exposure. None of the cement workers who had been in the work for fifteen years showed marked evidence of its effect. There was slight evidence of pneumoconiosis, but hardly any evidence of fibrosis. I hope the time has come when the dust fetish will be considered in its proper proportions. Our studies also proved the ease with which the protection of workers in these industries is possible. If they are *x*-rayed once a year

the advance of the disease is noted and checked by withdrawal from exposure to the irritation.

Dr. William H. L. Coplin: I am particularly interested in the contention that the organic dusts are harmless. Recently Dr. Jackson has had forced upon him the fact that if a peanut become lodged in the pulmonary tissue of a child death ensues in a short time, whereas a foreign body of metal may do little harm for years. Within a few hours organic foreign material induces a severe inflammatory reaction in the bronchi, giving rise to a very definite picture—at first an edematous bronchitis and later more or less marked induration and peribronchial infiltration. Vegetable protein introduced into the lung produces an intense reaction out of all proportion to that brought about by any other alien body not definitely corrosive or destructive, as chlorin, taken into the bronchi. It is hard for me to believe that the introduction of organic matter through the pulmonary system exerts no deleterious influence on the tissues. Most organic bodies, for example catgut, must be metalized (chromicized) otherwise the tissues attack them; often, though treated with chromium, absorption (which means tissue reaction) eventually occurs. Metal of a non-corrosive nature (gold, platinum, silver), and possibly organic material (catgut) when metalized, may establish a fibrosis resembling that to which Dr. Landis has referred. With our knowledge of the changes shown by the *x*-ray caused by inorganic substances I should be very much surprised if we could ignore this type of dust.

Dr. David Riesman: The work done by Drs. Miller, Smyth and Landis is very interesting. It is exceedingly important that we know the truth; if dust is harmless we shold know it, and yet it would be a very unwise thing if the City administration should become imbued with that idea and should cease effort to get rid of it in the summer. Dust may be harmless, but it is very undesirable. It is reasonable to assume that when mixed with bacteria the dust may carry them into the lungs. Moreover, it is probable that if we inhale street dust constantly we tire the cilia of the respiratory tract and choke the lymphatic glands at the hilus of the

lung so that they cease to be good reservoirs or graveyards for bacteria, which then either stay in the lung or pass through the glands unchecked. I take it also that there is a connection between irritating dust and coryza—not that the dust *per se* causes the coryza, but that it predisposes the nose to the localization of bacteria. Dr. Landis said that the cigar industry stands high in the tuberculosis column. I have heard such a statement before and I should like to know Dr. Landis's explanation. I would also ask Dr. Landis's opinion regarding wool-sorters' disease, which is an inhalation disease—pulmonary anthrax. The position of the silk industry at the bottom of the list in the dust column is accounted for by the fact that it is a moist industry, as the factories make use of humidifiers to keep the silk pliable. Finally, I ought to mention an interesting historical fact, so far not referred to by writers on industrial diseases, that Paracelsus early in the sixteenth century wrote a work on the dangers of the mining and metal industries.

Dr. H. R. M. Landis: In reply to Dr. Riesman's question regarding the high death rate attributed to the cigar industry, I may say that a year ago last summer I had under my care at White Haven from several counties in the northern part of New Jersey twenty to twenty-five young women, between the ages of eighteen and twenty-four, all of whom gave the history of being cigarmakers, and all of whom came from small manufacturing towns about Perth Amboy. Investigation of their living conditions showed these to be most unsatisfactory. The health appropriation for the towns was totally inadequate and largely absorbed by office expenses. The girls received low wages and lived under bad sanitary conditions. Examination of the cigar factory showed it to be beautifully lighted, up to date in every respect and absolutely free of dust. This I think is a very logical explanation of the high death rate from tuberculosis charged to dust in many of these industries. I do not, of course, think there should be any diminution in our effort to do away with the dust in manufactories. I believe it acts as a carrier in many of the infections of the respira-

tory tract. Investigation is welcomed by the manufacturers. Five years after I did the first work of this kind I received a letter from one of the pottery companies telling me of their improvements instituted to eliminate the dust, and stating that they had found they had been wasting in the dust, material which had a money value, to say nothing of the improvement in the health of their workers.

Dr. Miller (closing): I would emphasize Dr. Landis' remarks concerning cigar workers. I know of only two thorough investigations which have been made of the health conditions, as contrasted with the mortality diagnoses, of cigar workers in this country. One was made by Dr. Dembo, of the New York State Factory Investigating Commission, who found in 600 only slightly more than 1 per cent. to have what she believed to be tuberculosis of the lungs. During the last year I have examined 400 such workers, and my deduction was that only 5 had active pulmonary tuberculosis, and of these I was not entirely certain. Thus in the 1000 the rate was about 1.3 per cent. The workers whom I examined were in the better factories, mostly young girls and well paid, receiving from $10 to $20 a week. Subsequently I went into 40 or 50 smaller and less hygienic factories in Philadelphia and here I am sure the percentage would have been higher because of poor hygiene and smaller wages, with consequent poor living conditions. With Dr. Landis I believe these factors are responsible for the high tuberculosis mortality.

A Case of Estivo-autumnal Malaria Lacking the Typical Symptoms of this Disease

BY DAVID RIESMAN, M.D., AND R. D. SPENCER, M.D.

Dr. Spencer: The patient was admitted to the Philadelphia Hospital on November 29, 1917. His chief complaints were pain in the lower left chest, shortness of breath and generalized itching. His present illness began in July, 1917, while in Rabat, Morocco,

with a dull pain over the left side, gradually growing worse and radiating to the lumbar and lower left abdominal regions. He entered a hospital in Tangiers and there developed a mastitis of the left breast and seven days later a similar condition in the right breast. Important physical findings in the case were a large palpable mass in the left hypochondrium, dulness at the base of the left lung, at which point the patient states that he was aspirated in the Tangiers Hospital; a diffuse copper-colored papular eruption causing the severe itching; pronounced pallor of skin and mucous membrane and scattered and indistinct rales over the left lung. The interesting findings in the blood examination were the crescents and intracellular pigmented forms of estivo-autumnal malaria and leukocytes containing melanin. Fluoroscopic examination showed the enlargement in the left hypochondrium to be the spleen. The case is of interest because of its differentiation in symptomatology from the usual type of malignant tertian malaria. The history of one chill in 1914 and of five days' sickness in 1915, with the onset of the present pain of the left side in 1917, is distinctly not the usual course of symptoms of the disease. That the sulphur treatment given for the skin condition was not curative, with the fact that no burrows were observed, suggests that the skin lesion might represent one of the eruptions of masked malaria. The shortness of breath was probably due to the man's pronounced anemia. Explanation of the double mastitis is difficult. It might have been due to cysts formed by the filaria volvulus which form tumor-like masses in the lymphatics. The adults are rarely found in the blood. The fact that this parasite is confined largely to the Western coast of Africa, and that only two of these tumor-like masses were found, does not render this explanation very probable.

Report of a Case of Pulmonary Gangrene following Operation for Strangulated Hernia

BY DAVID RIESMAN, M.D., AND P. L. COOK, M.D.

Dr. Cook: The patient was a man, aged fifty-four years, a gardener, who had had a right inguinal hernia for twelve years;

also complained of dry cough for two years. He reports that in October last he was operated upon under ether anesthesia for strangulated hernia. He did well for two days, when he was seized with a cough and began to have an extremely offensive taste in the mouth. There was neither pain, fever nor sweats. He spat great quantities of offensive material but no blood at any time, and grew increasingly short of breath. He was admitted to our service in the Philadelphia Hospital on November 12, 1917, about two weeks after operation. The man was very toxic in appearance. Microscopically the sputum showed a great variety and profusion of organisms, but no tubercle bacilli. A major diagnosis was made of pulmonary gangrene following herniotomy, probably dependent upon the formation of a thrombus, or lodgment of an embolus in a branch of the pulmonary artery. Death supervened before the suggested surgical procedures could be instituted. Thrombosis of the pulmonary, according to Osler, is rare. Other writers do not distinguish it clinically from embolism, which is typically associated with chill, fever, pain and hemoptysis, all of which were absent in this case. Da Costa's reference to embolism as a possible etiological factor in some postoperative pneumonias is suggestive in this connection. The incidence of pulmonary embolism following major operation was 0.0046 in a series of 3657 cases at the Mayo Clinic, although Da Costa refers to a series of 1140 cases in which it occurred 23 times. In the surgical clinic it is seen most frequently after thrombosis of peripheral veins. Without this factor it occurs most often following operation for appendicitis, strangulated hernia and myoma of the uterus. Da Costa mentions 17 instances in which immediate operation was undertaken for removal of the embolus, with death in every case. The mortality of operation for pulmonary gangrene from all causes is about 30 per cent. In the present case autopsy showed a thrombus partially occluding the vessel in a branch of the pulmonary artery.

Clinical Results from Treatment of 212 Cases of Nervous and Mental Diseases of Syphilitic Origin, with Intraspinous Injections of Neosalvarsanized Serum

BY ALFRED GORDON, M.D.

Group I. 75 cases of cerebrospinal syphilis.
Group II. 35 cases of tabes.
Group III. 40 cases of headache.
Group IV. 22 cases of paresis.
Group V. 17 cases of neuroses.
Group VI. 23 cases of psychoses.

After several years of experience with the Wassermann reaction in cases with syphilitic involvement of the nervous system the following statements, I believe, could be considered as incontrovertible.

1. Not in every case the reaction is positive. It may safely be said in about 60 per cent. to 70 per cent. it is positive in the blood serum.

2. It is more frequently positive in paresis, less frequently in cerebrospinal syphilis, and still less frequently in tabes.

3. The spinal fluid gives more frequently a positive Wassermann than the serum.

4. The examination of the spinal fluid is of greater value in syphilis of the nervous system than that of the blood serum.

5. A negative Wassermann does not exclude absolutely a syphilitic involvement of the central nervous system.

6. Energetic treatment with salvarsanized serum may render the Wassermann reaction negative and still the clinical symptoms remain unaltered or improve but slightly.

7. The proper treatment may improve greatly the clinical manifestations and still the Wassermann reaction may remain positive for a long time.

8. Neither does the degree of intensity of the Wassermann reaction always bear a direct relationship to the number or intensity of the clinical symptoms.

These few observations have been verified repeatedly by the majority of careful students of the subject of syphilis. In view of the contradiction existing between the laboratory reactions and the clinical manifestations, a contradiction which I could fully corroborate, at least from my present study, I will refrain from giving detailed data concerning the biological state of the serum and of the spinal fluid before and after the treatment, and will confine myself almost exclusively to the clinical results. I must say, however, that in every case, without exception of this special study, a Wassermann test as well as a cytological examination of the spinal fluid were carefully carried out.

The entire series of 212 cases comprises the following groups: 75 cases of cerebrospinal syphilis, 36 cases of tabes, 40 cases of headache, 22 cases of paresis, 17 cases of neuroses, and 23 cases of psychoses.

The most satisfactory results were those in the first group, viz., in cerebrospinal syphilis. Next in order were those of the headache cases. The tabetic cases follow, then the neuroses, then the paretic cases, and finally the psychoses.

The treatment was uniform in all the cases so far as the preparation of the serum is concerned. In accordance with Swift and Ellis's directions the full (0.9) dose at first or 0.6 of neosalvarsan in some cases was injected intravenously. The withdrawing of blood, centrifugation, inactivation, dilution with normal salt solution, lumbar puncture, and injection of the serum—all these procedures are now classical. With few modifications each procedure was carried out as the originators recommended,

Group I. The 75 cases of cerebrospinal syphilis presented more cerebral than spinal symptoms. Amelioration was obtained invariably after the first injection of neosalvarsanized serum. The mental hebetude which was present in a few cases totally disappeared. The condition of the cranial nerves, particularly in the domain of the third and sixth nerves, responded promptly to the treatment. The hemiplegias of very recent origin rapidly improved. Aphasia was frequently associated with a monoplegia of the right arm. The sooner after the onset the treatment was administered,

the better results were obtained. It was noticed that the arm improved much more rapidly than the leg. The reflexes also participated in the improvement, so that the increase of the knee-jerk was but very slight and the extension of the toe became also very slight. In 3 out of 7 hemiplegic cases the toe phenomenon disappeared entirely and the plantar reflex became normal. In some hemiplegics the improvement was so marked that the condition could be considered normal. This occurred only in the cases in which the treatment was instituted a few days after the apoplectic insult, and in cases with a very mild hemiplegia, also in cases in which at least three injections of the serum were made. In all these hemiplegics there was no loss of consciousness, and the attack consisted of sudden paresthesia on one side of the body, which soon was followed by a paresis. In the cases with loss of consciousness and a more pronounced paralytic state of half of the body, also in the cases of longer standing, the results of the treatment were less pronounced and improvement was perceptible only after the fourth injection. It was evident from this experience that cases with thrombotic occlusion of cerebral bloodvessels are more favorable for the effect of salvarsanized serum than cases with presumable hemorrhages in the cerebrum. Very satisfactory results have been obtained in cases with a condition known as spasmodic closing of bloodvessels, cases in which are observed repeated attacks of mild hemiplegic or monoplegic states. It occurs in individuals with a degenerative state of the bloodvessel walls either of syphilitic or senile origin. (See *Jour. of Nerv. and Ment. Dis.*, August, 1914.) Here as soon as the condition was recognized the above treatment was promptly instituted and from one to two intraspinal injections were sufficient to improve the condition greatly. In 2 cases for twelve and seventeen months respectively no attack occurred.

In 5 cases there were cerebellar manifestations. Asynergia, tibulation, unequal reflexes, the position of the head, a more or less marked edema of papilla, severe headache—all or some of these symptoms were present and suggested a cerebellar involvement. Fortunately in every one of them the Wassermann test

was positive (4 cases in the spinal fluid and 1 case in both serum and spinal fluid). The treatment removed the above-mentioned symptoms after one to four intraspinal injections. In 1 case the most brilliant result was rapidly obtained from one single treatment.

In the cases with symptoms showing involvement of the spinal cord the intraspinal method has proved to be equally satisfactory, especially in the recent cases. In several cases of myelitis the paraplegia and the subjective sensory disturbances (pain, tingling, burning, etc.), became greatly ameliorated. Special mention in such cases deserves the condition of the sphincters, as the first and most marked improvement. I have noticed it in the function of the bladder and after the first injection. In cases of old standing while the improvement was evident, nevertheless it was obtained only after several injections and it was not as conspicuous as in the early cases. Sexual function was recovered in one case of a man, aged thirty-eight years, who had a syphilitic myelitis of several years' standing but whose impotence existed for eighteen months.

One patient of the cerebrospinal group presented symptoms of multiple sclerosis, viz., optic neuritis in one eye, nystagmiform movements of both eyes, intention tremor, plus knee-jerks, and Babinski on both sides. The case was of old standing. After the third injection the intention tremor became exceedingly slight and the patient's general condition improved, but the other symptoms remained unaltered.

The following case presented the most striking results from the treatment.

A young man, aged thirty years, whose spinal fluid gave a strongly positive Wassermann reaction, presented at the first examination almost complete paralysis of the lower extremities, exaggerated knee-jerks, double ankle-clonus, and double Babinski. The legs were not spastic, but there was no undue flaccidity. There was retention of urine and obstinate constipation. The upper extremities were markedly atrophied, especially the small muscles of the hands; the latter were claw-like. The muscles of

the thorax and the scapular muscles were also atrophied. One eye presented optic neuritis. There was also external strabismus in the left eye. The patient suffered excruciating pain in the arms and legs, so that he could not sleep. He was promptly given an intraspinal injection. Rapidly the pain began to subside. Soon the leg gained some motion. The arms, which were extremely weak (one more than the other), gradually gained power. In three weeks the patient was given another treatment. Rapidly further improvement became very noticeable. He was able to move his legs and sit up. The pain had totally disappeared. The hands and arms gained power. The bladder functionated normally. He received three more intraspinal injections at three, six and eight weeks' intervals. The patient commenced to walk with crutches, which he could discard at the end of the following six weeks. Presently he was able to do some work as a collector. There is no difficulty in walking; the knee-jerks are still increased; Babinski is present on one side; ankle-clonus disappeared. The upper extremities have gained greatly in power and in muscular tissue; the atrophy of the hands is very much less marked and the grip of both hands is fairly good. The bladder is normal. The unilateral optic neuritis remains unaltered, but there is no strabismus. The result is highly satisfactory.

Group II. The 35 cases of tabes present many interesting therapeutic features. First of all every one of the cases, without exception, benefited to a greater or less degree. In the younger cases in which the symptoms were not pronounced the favorable results were striking even after two injections. In the cases of older date the results were less beneficial, and they required a larger number of injections than the patients having tabes of a more recent date. The number of injections also varied greatly. One patient, for example, a locomotive engineer, presented at the time of the examination lancinating pain in the lower limbs, slight ataxia, loss of tendon reflexes, and occasional retention of urine. He received but one intraspinal injection, and in four weeks he returned to his work totally free from the pain and the ataxia; the bladder disorder had also disappeared. He refused to have

other injections, and for the last two years has been able to do his work. While his knee-jerks are still absent, but the other manifestations have not returned. Another patient, a leader of an orchestra and a violinist, found himself unable to make a livelihood because of paresthesiæ in both hands and an inability to feel properly the various strings of his instrument. Examination revealed ataxia, Romberg sign, loss of knee-jerks, and of tendon Achilles reflex, some ataxia of the upper extremities and retention of urine. He received but one instraspinal injection. In three weeks the paresthesiæ of the fingers had totally disappeared. He regained the sensation in his fingers, the ataxia and the bladder improved greatly. Presently, twenty-five months after the treatment, he is again at his work, is perfectly able to control his fingers, and the ataxia and the bladder symptoms have disappeared. What is especially interesting here is the return of the knee-jerks. The tendon Achilles reflex, however, is still absent. The patient refuses further injections. The return of the patellar tendon reflex occurred in another case of my series, also in tabes of younger date, and in which the symptoms have not yet reached their fullest development. The number of injections required to obtain beneficial results were small in the majority of the cases of tabes of younger date, but there was no parallelism. In some patients rapid improvement was obtained from one injection, in others similarly affected two or three injections were necessary before similar improvement was obtained. This irregularity in results was equally observable in cases of tabes of older date in which a larger number of intraspinal injections was given before favorable results could be observed.

Group III. There were 40 cases of headache. Serologically only 31 cases gave positive Wassermann either in the blood (11) or spinal fluid (20). The other 9 cases presented histories which were highly suggestive of syphilitic infection. Thus I traced several miscarriages, suspicious scars over the body, a history of the hair falling out at young age, repeated ulcerations in the pharynx, etc. The results in all the cases except one was highly satisfactory. In the cases of recent as well as older date the favor-

able affect from the treatment was invariably uniform. The number of injections varied, but it was small in the majority of the cases. Usually one or two injections were required to obtain improvement. In 5 cases of many months' standing only one injection was given, with the most brilliant results. Recurrences of headache took place in the majority of the cases, but repeated injections promptly removed the disorder. Similar results were obtained in the 9 cases with the negative Wassermann and they required as many injections as some of the other cases. In none of these 40 cases was there in evidence somatic manifestations such as observed in the first group, but in all of them the patellar tendon reflex was increased and no other abnormal reflex was observed. They were manifestly cases of cerebral syphilis but in which the only conspicuous symptom was headache, probably due to a diffuse meningeal involvement. The cytological examination showed in all the 40 cases a lymphocytosis, the number of cells ranging between eight and eighteen. The patient mentioned above who did not respond to the intraspinal treatment is the one whose detailed record was published in *Jour. Am. Med. Assn.*, October 30, 1915. Although he presented some spinal symptoms and belonged to the first group of cases, nevertheless he was included in Group III because of the unusually severe and extraordinarily persistent headache. In this case, while the intraspinal treatment removed the spinal symptoms, nevertheless it failed to relieve the headache. Recovery followed an injection of neosalvarsanized serum into the cerebral subdural space.

Group IV. This group embraces 22 cases of paresis. There were 12 cases of early paresis and 10 advanced cases. In the latter subgroup the treatment either made no impression at all or showed some slight improvement in the mentality, but the obtained amelioration did not last long. This was observed after each injection. Even ten injections failed to bring on a prolonged improvement. The condition, however, was greatly different in the early cases of paresis. Here not only amelioration of the symptoms was in evidence soon after the first two injections, but also the duration of the improved period was decidedly greater

than in the advanced cases. Moreover the improvement was so apparent to the relatives of the patients that they frequently declined, for this reason, to have the patients subjected to repeated injections. As to the improvement itself it occurred mostly in the mental manifestations. The memory, the power of realization of their infirmity, also the power of self-criticism, which are so frequently involved in paretics—these are the faculties which showed a certain degree of improvement. In 2 cases the latter was so pronounced that not only the patients' relatives but also the attending physicians doubted the correctness of the diagnosis, and it was seriously doubted, for a long time, until recurrences took place. As to the somatic symptoms, with the exception of the speech, all others remained uninfluenced by the treatment. In order to maintain the improved condition a large number of injections was necessary in the recent as well as in the advanced cases. In 3 of the early cases from 13 to 22 injections were given. Improvement and even considerable improvement was obtained within a period of two years, but it is far from being considered a recovery. Such patients will have to continue the treatment until they reach the point of intolerance, and when the latter arrives the injections will have to be totally abandoned, and this will lead inevitably to a return of the former mental disorder, which will mean a final progressive deterioration.

Group V. The 17 cases of neuroses include neurasthenics and psychasthenics. Among the latter there are cases with various forms of obsessions, cases with anxiety neuroses, with abulia, folie de doute and hypochondriasis. As their humors gave positive Wassermann reactions, they were submitted to the same treatment as the other groups. Improvement was observed in every case without a single exception. Not many injections were required. The largest number was four. In 10 out of 17 marked improvement was noticeable after the first treatment. In 2 cases only one injection was administered, and the improvement was so marked that at the end of eight months it was considered by the family a recovery, although the Wassermann reaction was still feebly positive. To ascribe the improved mental condition and the disap-

pearance of obsessions in some cases exclusively to the effect of the salvarsanized serum, would not be rigidly accurate, as one must bear in mind that psychoneuroses sometimes improve and even disappear under the influence of various methods of treatment, such as suggestion, persuasion and psychanalysis with the finding of psychogenetic elements. Parallel with the intraspinal antisyphilitic treatment all these methods have been employed. Whether the latter were the deciding factor in the striking improvement of some cases it is not absolutely possible to say, in view of the fact that all cases were treated by the above-mentioned procedures long before salvarsan was employed here, and some of the cases showed no improvement at all until the intraspinal injections were used. In this connection it is important to mention the absence of parallelism between the improvement of the psychic manifestations and the Wassermann reaction, as the latter remained positive in spite of the disappearance of psychoneurotic phenomena; also, that the cellular elements of the spinal fluid considerably diminished alongside the persistent positive complement-fixation test.

Group VI. The 23 cases of psychoses embrace all varieties except paretic dementia. In 20 cases the Wassermann reaction proved to be positive in one or the other, or in both humors. In 3 cases the reaction was negative, but the histories pointed to a syphilitic infection. Several miscarriages, cachectic appearance, headache, eruptions in younger age—all indicated a possibility of infection. Like the other 20 cases these 3 were also submitted to the intraspinal treatment. The relation of syphilis to psychoses is of utmost importance and forms the subject of a special study to be contributed by me elsewhere. Manic-depressive psychosis, dementia precox, involutional melancholia, and Korsakoff's psychosis were all represented in Group VI. While all the patients improved in their mental manifestations, probably because of their syphilis, nevertheless the clinical pictures, the course of the diseases, the subsequent events did not authorize me to draw a precisely direct relationship between their potential syphilis and the typical forms of the psychoses. In the other contribution already alluded

to, facts will be brought forward for such a contention. It will be shown that it is difficult to admit that syphilis, many years after the initial infection, is capable *per se* to create such distinctly classical forms of psychoses. What is possible to assert is that syphilis of old standing is apt to bring in modifications in psychoses which would have developed irrespective of the presence of syphilis. If improvement from antisyphilitic treatment was obtained, the effective influence was manifested precisely in those modifying elements, which being added, have altered the usual manifestations and of course of the mental phenomena. For example, hallucinations which occurred in the manic-depressive psychosis, and which were coincident with a high cellular count in the spinal fluid, improved greatly and even disappeared after the treatment. Improvement was obtained in the largest majority of the cases. The number of injections varied from case to case. While recurrences did take place, nevertheless the degree and rapidity with which the amelioration in the mental status of the patient took place are sufficient reasons to justify the above treatment in every form of psychoses in which a complement-fixation test is positive, also in cases in which the history and the antecedents present sufficient ground for presumption of syphilis. The salvarsanized serum not only removes the above-mentioned modifying elements, but also has a favorable influence on the course of the psychoses; remissions set in early and in some cases they are prolonged.

Conclusions. The results obtained in the 212 cases are bound to develop a spirit of optimism in management of cases with evidences of syphilis. In some cases the expectations are greater than in others, as for example in early cases. In some cases the amelioration of the nervous and mental manifestations are short of being considered brilliant and indeed it is apt to render one highly enthusiastic. But a calmer consideration of the actual facts, especially when the cases are followed up for a sufficiently long time does not permit me to be oversanguine in spite of the favorable results obtained in the majority of my cases. There were sufficient recurrences to warrant a conclusion that the last word in the treatment of nervous and mental diseases of syphilitic origin is far from

having been spoken. On the other hand, a mere comparison of the results obtained from the old methods of treatment with those from the newer procedures must convince an impartial observer that the latter are much superior to the former. The largest number of my cases, except the psychoses, have been treated with mercurials and iodids for a considerable time prior to coming under my observation with a slight or no success at all. The cases in which some success had been obtained with those remedies cannot stand comparison with the cases to which the intraspinous treatment has been applied. In the latter the results had been at times so strikingly satisfactory that for the present at least it appears to be the only procedure in which hope can be placed for checking syphilitic diseases of the nervous system. A procedure that enables us to bring spirocheticidal reagents into direct contact with the cerebrospinal system, intraspinally and intracerebrally seems to be the most logical one. The fact itself of giving satisfactory results in most serious affections is most encouraging and promising. It points the way in which our efforts should be directed. The future success lies in the perfection of this method.

Fixed Ideas in Medicine

Now and then in a medical paper or discussion one hears brief reference to the psychic factor. This reference is usually merely a passing one, as if the matter were of little or no value save to be eliminated as a source of error.

The great advance in medical science after its disassociation from the occult and the mystical cannot be denied, but there is such a marked materialistic tendency in the medical view-point today that it may not be amiss to consider the practical importance of despised psychology as a factor in diagnosis and treatment.

It is the internist particularly who sees disease in all its varied manifestations, and it is to the interest of the patient that the physician's view-point be broad and unbiassed, and thus the over-zealous enthusiasm of some specialists may be counter-balanced.

Adolph Meyer ("Objective Psychology or Psychology, with Subordination of the Medically Useless; Contrast of Mental and Physical, *Journal*, September 4, 1915, p. 860) has said that common sense has never worried about the reality of the world, and that the time is approaching when we shall cease to worry about the reality of the so-called psychological phenomena and their definite relation to human physiology.

It is because of the writer's strong belief in a growing interest in this subject, and the great practical importance of disarming the quack and the so-called irregulars whose knowledge of suggestion is often surprising, that this paper is presented.

J. Victor Haberman (*Am. Med. Jour.*, March 14, 1914, p. 845), of Columbia University, has emphasized the value of a study of the expectant attention as definitely affecting results in disease. The fixed notion in the mind that a certain goal will be reached produces a physiological reaction that helps toward recovery, chronic invalidism, or death. Whether or not the subconscious suppressed desire theory of Freud be accepted as a cause of neuroses, certain it is that this author has stimulated investigation along psychic lines by the profession. Up to within the last few

years this subject has been so closely related to the practises of the charlatan that the writer ventures the opinion that the medical profession has been somewhat overzealous in avoiding the study lest its own skirts be smirched.

Medical knowledge advances only by unbiassed analysis of the new ideas presented to it. We are about to modify our conception of vaccine therapy due to the work of Jobling and other investigators. The present war has produced much controversy regarding antisepsis. The surgeons' concept of the treatment of compound comminuted fractures has been markedly changed in the last year or two. The developments in physiological chemistry have concentrated our attention of late on acidosis, the sugar content of the blood, and the carbon dioxide tension of the alveolar air. One is impressed, as our knowledge advances, with the great delicacy of the chemical reactions of the body and what comparatively slight influences may throw our metabolic processses out of order. What we believe today is often changed on the morrow. The writer dares to prophesy that there is coming a period when the same accurate and unbiassed laboratory and clinical study will be as universally given to physiological psychology as is now devoted to purely physical diagnosis.

The theme then is this: Medical men, as experience in life advances, acquire set methods of thinking regarding disease. There is an habitual expectant attention. The writer spent three months in the office of the American Medical Association, during the past summer, and many medical papers sent in for publication were read. One was impressed with the narrow view-point of many. For instance, one writer insisted that influenza was nothing but an acute inflammation of the sphenoid, with systemic symptoms, and that the proper prophylactic measures would be to remove the end of the middle turbinate, enlarge the sphenoidal opening, treat and drain, and the disease called la grippe would cease to exist.

Each patient also possesses individual habits of thought. Their minds, subconsciously, if you will, are aiming toward various goals. The view-point of the physician influences the direction

of the expectant attention of the individual, and this influence exercises a definite effect upon the body in increasing or decreasing its resistence to disease.

The paper by Cannon, read before the New York Academy of Medicine, October 1, 1914 (*Jour. Am. Med. Assn.*, October 17, 1914, ii, 1415), presents suggestive evidence of the physiological effects produced by the primary emotions—fear, anger, and excitement. These can be studied experimentally in the lower animals. He states that the changes produced are more profound than those brought about by any other effective states. Fear produces the lessening of glandular secretion, the inhibition of smooth muscle, marked dilatation of the pupil, a stimulation of the pylomotor mechanism, and marked pallor caused by contraction of the cutaneous vessels. In anger, anxiety, or distress there is a complete cessation of the movements of stomach and intestines. During some types of excitement the secretion of every one of the digestive ferments is lessened. It has been demonstrated that the blood of excited animals contains an excess of adrenalin. It has been shown that the injection of adrenalin brings about an increased liberation of sugar from the liver, sometimes to the extent of producing glycosuria; and this phenomenon fails to take place after the removal of the adrenals.

Cannon studied the urine of 25 members of the Harvard football squad after the Yale game in 1913. Glycosuria was found in 12; 5 of these did not play, but saw the game. The inference is that in these 5 the glycosuria was caused by excitement alone. Cannon theorizes that war and increased adrenalin secretion go hand in hand. If this be true the suprarenals must have been working overtime of late. The work, however, illustrates the marked physiological effects of emotional states.

During the Christmas season the writer chanced to glance into one of the wards of a well-known hospital. The room was all bedecked with Christmas greens and various symbols of the joyful season. Down the long aisle, lined with sick on either side, a dead man was being carried out by two slovenly orderlies. The body lay upon a narrow stretcher. It was covered with a black rubber

cloth, well tucked in, so as to make the outline of the corpse pronounced. Around the neck, outside the cloth, was tied tight a muslin bandage. Somehow the whole markedly suggested the death mask and the hangman's noose. As one watched the frightened faces of the sick peeping over the bedclothes the work of Cannon, just cited, came to mind. Is it assuming too much to believe that the direction of the expectant attention induced in the minds of the sick, as they saw this ghastly burden passing by, produced for some, at least, a lessening in the natural bodily resistence to disease. A sensitive young Italian boy, with advanced pulmonary tuberculosis, saw three men die in the small ward which he occupied. He conceived the notion that the patients were all being poisoned, and refused all food himself. Shortly he died. What was the cause of death? Obviously, primarily, pulmonary tuberculosis, but the immediate contributing factor was starvation, due to a misdirected expectant attention.

In answer to an inquiry regarding his success a rather distinguished specialist replied, "I hold my patients and never let them go." One felt the strength of the iron will of the man in the cadence of the voice. There is a peculiar faculty possessed by some men to keep people ill and yet make them dependent on their medical adviser. This same faculty may be used to aid in getting people well. It is simply dependent upon the direction of the expectant attention. The man who can teach the patient to be dependent can usually teach him to be independent. We are all familiar with that curious class of people who love their ills and their symptoms. Their minds are usually rather vacant; the daily visit to the doctor's office one of the joys of life. These people commonly have means and unlimited leisure. It requires a careful psychological analysis and tactful treatment to train these individuals to stand on their own feet. To offend by telling them there is nothing the matter only produces antagonism and they go elsewhere, and the whole process is repeated. Operating on these cases for psychical effect usually results in but a temporary improvement, and when the relapse occurs another operation is done; and we thus have that pitiable class of patients who have

gone through many surgical procedures in various hands; their last condition is usually worse than the first. It takes time, patience, and thought to teach these people to redirect their attention; and it requires much more than a kindly manner and a pleasant smile on the part of the physician.

But the man or woman with definite demonstrable organic disease cannot be neglected from the psychical view-point. The writer has lately seen a case in private practice in which a diagnosis of pulmonary tuberculosis had been correctly made, but the emphasis had been laid on the seriousness of his condition and the unlikelihood of recovery. After determining that the young man really had a slight pulmonary lesion, the only thing that was done for him was to change his expectant attention from depression to optimism. The case had been well instructed in how to care for himself regarding food and fresh air and a systematic life, but this one factor had been neglected. The change in the young man's condition for the better is a striking example of what every physician commonly sees as a result of the right kind of suggestion in a given case.

One of the most important class of diseases in which the harmful effect of certain fixed ideas is often seen are the cases that come under the general head of hypertension. This the writer has seen both in physician and layman. An individual often without symptoms discovers through insurance examination that he has a systolic pressure of 190 mm. At once a long train of symptoms set in. The man's mind becomes fixed on his high blood-pressure and the possible consequences. He awaits the result of each reading with ever-increasing anxiety. In chronic cases, with more or less permanent changes in the vessels, there is often little variation in the pressure despite the most careful and thorough search for the cause and the best known treatment. It is rather curious that the profession generally is perfectly willing to admit worry and nervous strain as a causal factor in hypertension, but seems rather loath to concede the importance of the psychic factor in most forms of treatment. The discovery of a source of infection or toxins is of importance, but despite this, as has been

said, very commonly little improvement results. Drugs, electricity and hydrotherapy have possibly some value, but the patient must be taught, without unjustifiable deception, the most hopeful attitude toward the condition if life is to be prolonged. The particular form of suggestion required differs very largely with different individuals.

On the other hand, some individuals are overindifferent to their physical ills and their minds are so absolutely set on health, no matter how depressing the surroundings, that they exhaust their mental resources by an exaggerated attempt to deny the facts of disease. The goal to which the rational therapeutist is aiming is to find that balance in which both mentally and physically the individual is doing his best to combat the pathological condition present.

The faker, quack, and charlatan, together with the patent medicine man, because of their ignorance as to the nature of disease, state their assurance of success with redoubled forcefulness. The harm done to gullible humanity by this class of people cannot be overestimated; but the lure of the label toward health has a certain percentage of successful results, and this fact is worthy of serious consideration. The classification of temperaments is as important as the classification of goiter or chronic joint disease or diabetes. For instance, there is the type of individual who habitually conceals the truth. There is the type who always attributes any bad symptom to the remedy administered. There is the type who suffers introspectively and who grows worse and worse because of a lack of expression. There is the type who improves temporarily on any remedy from anybody; these are the people who are to some extent responsible for the ponderous complexity of our present materia medica. There is the type who always sends for the doctor but never takes his advice. There is the type whose only use for the doctor is that he may tell him it is best for him to continue his bad habits. There is the type who always diagnoses his own case, and is mortally offended if you do not agree with him. There is the type that has a mania for surgical operations. There is the type that has an

abnormal fear of the knife. There is the type that always states that he wants to know the worst when he really don't want to know anything of the kind. There is the type who never considers himself sick but sends for the doctor because he likes him. There is the type who on all occasions are sure they are going to die. There is the type who wants to make as little trouble as possible and makes more than anybody else. There is the type who is habitually suspicious. There is the type who has a smattering of medical knowledge and whose joy in life is to tell the doctor something that he thinks he does not know. Finally, there is the type who meets disease with a strong purpose to get well and a sane recognition of the powers and limitations of the physician. Each one of these may have, let me say, organic cardiac disease. The treatment of each is a distinct psychical as well as physical problem. They will respond differently to drugs as well as to suggestion.

The writer is well aware that many so-called neurasthenics are found to be tubercular when carefully examined. We read much of obscure chronic disease and undiscovered focci of infection as the cause of various neuroses, but not enough of the management of these conditions in the neurotic individual. Accurate diagnosis is the foundation stone of rational therapy. This diagnosis must include the man as well as the disease. Each individual has certain fixed habits of thought, and these should receive the same careful analysis as is given to the physical and laboratory findings in a given case. There are already indications in medical teaching and in practical clinical work that the importance of this subject is being realized.

PROCEEDINGS

OF THE

SECTION ON INDUSTRIAL MEDICINE AND PUBLIC HEALTH

JANUARY TO DECEMBER

MAY 9

Some Theoretical and Practical Aspects of Industrial Medicine

BY FREDERICK L. HOFFMAN, LL.D.

I SINCERELY appreciate the opportunity of this discussion and hope that I shall be able to do it justice. The subject is one to which I have given much time and thought for many years, although most of my personal investigations have been limited on the one hand to the frequency of tuberculosis in relation to the so-called dusty trades and on the other to the frequency of industrial accidents in the more hazardous industries. For self-evident reasons it has not been possible for me to make technical studies of the more involved problems in industrial hygiene, such, for illustration, as the occupational affections of the skin, or industrial poisoning, or say poisoning by arseniuretted hydrogen or hydrogen arsenide, which has been made the subject of an admirable monograph by Dr. John Glaister, of the University of Glasgow. To a very limited extent, however, I have concerned myself with certain occupational aspects of cancer, in regard to which the existing

literature is unfortunately too limited to justify entirely safe conclusions. The business of life insurance requires a reasonably thorough knowledge of occupational hazards, and it is but natural that the accumulated experience of a life insurance company should suggest more or less highly specialized inquiries to ascertain the correctness of a company's rating practice and a reconsideration of extra premium charges from time to time in the light of a broader knowledge of more or less far-reaching changes in industrial processes and conditions. A truly immense mortality experience is being brought together by the large industrial insurance companies, for in the case of such a company as the Prudential the number of deaths subjected annually to critical analysis exceeds 100,000 at the present time. Life insurance experience has the additional value in that the original application contains important information not available in the case of deaths as officially reported to the public authorities. I question whether any other company in the world has examined as exhaustively as we have done into the underlying conditions and circumstances of the mortality by occupations, race and locality as has been the practice of the Prudential for more than twenty years. In connection with these investigations we have accumulated a considerable amount of exceptionally valuable information on practically every occupation or industry and the occupational diseases or special mortality problems related thereto. To a limited extent the results of our investigations have been made available through bulletins of the United States Bureau of Labor Statistics and the Bureau of Mines and of exhibits, of which the most important one was contributed by the Prudential to the Panama-Pacific International Exposition held in San Francisco in 1915. The Bureau of Labor Statistics deserves much credit for a long series of admirable monographs on special occupational diseases, of which those by Dr. Alice Hamilton are of the first order of scientific and practical importance. Within recent years highly specialized investigations of this kind have also been made, and are being made, by the United States Public Health Service and the United States Bureau of Mines. In addition thereto a number of important and practi-

cally useful investigations have been made by State labor departments, workmen's compensation boards, special occupational disease commissions, etc.

On the basis of a conservative estimate not less than 5,000,000 men and women in this country are, while at work, continuously exposed to the risk of injurious industrial dust. Nevertheless the medical profession has been incredibly indifferent, and what little we at present know regarding pneumonoconioses, for illustration, is chiefly derived from foreign sources. The close relation which is known to exist between dust exposure and the mortality from tuberculosis and non-tuberculous respiratory diseases has failed to attract sufficient attention on the part of the medical profession to provide us with a trustworthy literature applicable to the solution of our own problems in the light of our own understanding. The wasted opportunities for scientific research in former years are an appalling evidence of the apathy and indifference prevailing in the past. It is gratifying, however, to note a profound change in this respect within recent years, but we are far from having attained to the required degree of public interest and public support in the furtherance of the numerous and often highly involved special studies which are absolutely essential to the establishment of industrial hygiene in this country on a strictly scientific and yet practical basis.

In England, France, Germany and Austria industrial medicine has been much further developed than in this country. In a measure the reasons are not far to seek. We have never suffered from such lamentable industrial conditions as prevailed in the past and still prevail to a considerable extent in the countries referred to. Even the most diligent research fails to bring forward the required evidence that cases of industrial poisoning, for illustration, are as common in this country as abroad. Our factory hygiene is of a higher standard and the same conclusion applies to the personal hygiene of the factory workers, aside from higher wages, better food, better housing and a higher standard of life generally. While this is true for the country at large there are of course many notable exceptions. There can be no question,

for illustration, but that miner's phthisis is as common in some sections of this country as in South Africa, where the disease has been made the subject of highly specialized and strictly scientific methods of inquiry for a number of years. Our own investigations in this field are of comparatively recent date and by no means as thoroughly sustained by scientific methods of a high order as fortunately has been the case abroad. There are no reasons why we should not follow the South African precedent and initiate in this country a corresponding inquiry into a subject which lies at the root of the metal mining problem. With the growth of the doctrine of workmen's compensation for industrial diseases any and all of these matters will naturally attract more qualified attention in this country than has been the case in former years, for just as soon as the employer is required to pay compensatory damages for apathy and neglect in matters of factory hygiene the required investigations as to causes and conditioning circumstances will unquestionably be made and the necessary remedies will be forthcoming.

It, however, would be an error to view industrial medicine only from this narrow point of view. The conditions of modern industry are fundamentally different from those of the past. The vast corporate development of industrial enterprise has brought about a community of interest between employer and employee unknown in former years. The United States Steel Corporation, for illustration, has probably not far from 500,000 workmen whose health, longevity and welfare are as much a matter of serious concern to the company as the cost of production and the earning of dividends. The truly admirable Bureau of Safety, Sanitation and Welfare of the United States Steel Corporation is but one of countless modern instances of a new policy of industrial management. At least all the large business concerns have realized the supreme importance of good health and physical strength. Accidents and sickness in industry, absences from work, industrial fatigue, etc., are all questions of labor and industry which today receive decidedly more consideration than in the past. Many of the large industries now employ factory physicians who have formed them-

selves into a national association, the proceedings of which bear evidence of rapid growth and further future development. The convention of industrial physicians called annually by the State of Pennsylvania is one of the many indications of a realized opportunity to better meet the medical needs of those employed in industry. The fourth annual convention of the Industrial Physicians of Pennsylvania was attended by more than 250 physicians, who met in the State House at Harrisburg under the auspices of the State Department of Labor. The papers read on that and previous occasions constitute a most useful contribution to the subject of industrial hygiene, however much in its beginnings the science of industrial medicine may be at the present time. At the outset it is unavoidable that such discussions should have chiefly to do with matters in general rather than with highly specialized aspects of industrial medicine. Such a congress, for illustration, as was held in Düsseldorf in 1912 could hardly take place in this country at the present time. To the extent that compensation for industrial diseases becomes the accepted policy of the several States the more involved aspects of industrial medicine will also receive more adequate consideration. Thus, for illustration, the question has been raised as to whether miner's nystagmus occurs in this country or not. The disease is sufficiently common in the coal-mining countries of Europe to justify the assumption that cases must occur, if but to a very limited extent, in the coal-mining regions of this country. The United States Bureau of Mines has published a bulletin on the subject, which, however, is practically limited in its presentation of facts and conclusions to the experience which has been gained abroad. If compensation were required in cases of miner's nystagmus contracted in the coal mines of Pennsylvania it is a reasonable conclusion that such cases would become better known to the members of the medical profession than is the case at the present time. The same conclusion applies to cancer in relation to occupation. The literature on the subject is almost exclusively foreign, but evidences are not wanting that cancerous affections resulting from peculiar occupational conditions are also met with in the United

States. If compensation were required medical and other important facts at present ignored or unknown would become a matter of common knowledge and official record.

Within recent years, however, gratifying progress has been made in the United States toward a literature of occupational diseases such as is absolutely essential as a basis for practical instruction purposes. The two standard works by Drs. W. Gilman Thompson and Kober and Hanson are encouraging indications of qualified scientific interest in a field in which there remain abundant unrealized possibilities for the future. Among the contributions to the treatise by Kober and Hanson on *Diseases of Occupation and Vocational Hygiene* are discussions on "Arsenic Poisoning," by Legge; "Carbon Bisulphide Poisoning," by Hayhurst; "Lead Poisoning," by Oliver; "Manganese Poisoning," by Casamajor; "Mercury Poisoning," by Teleky; and "Chronic Phosphorus Poisoning," by Hamilton. Among the occupational infectious diseases anthrax is of the first importance, and the work includes an admirable discussion of the subject by Frothingham. "Compressed Air Illness" is discussed by Erdman and the "Effects of Diminished Atmosphere upon Health," by Kober.

The most indefatigable and useful original worker in the field of industrial hygiene in the United States is Dr. Alice Hamilton. Most of her contributions have been published in the form of bulletins by the United States Bureau of Labor Statistics. Among these the following are of the first importance: "The White-lead Industry in the United States, with an Appendix on the Lead-oxide Industry;" "Lead Poisoning in Potteries, Tile Works, and Porcelain Enamelled Sanitary Ware Factories;" "Hygiene of the Painters' Trade;" "Lead Poisoning in the Smelting and Refining of Lead;" "Lead Poisoning in the Manufacture of Storage Batteries;" "Industrial Poisons Used in the Rubber Industry;" "Hygiene of the Printing Trades;" and "Industrial Poisons Used or Produced in the Manufacture of Explosives." American labor and industry owe a lasting obligation to Dr. Hamilton for her remarkable contributions in a field of inquiry in which every investigation involves not only a considerable degree of personal

exposure to more or less dangerous and unwholesome conditions, but where frequently exceedingly involved technical difficulties have to be overcome in an effort to arrive at conclusions of practical value. The work of no foreign author on occupational diseases is of a higher degree of intrinsic value than the scientific contributions of Dr. Alice Hamilton.

Perhaps next in the order of importance is the work by Dr. J. Rambousek, professor of factory hygiene and chief State Health Officer of Prague. His work on "Industrial Poisoning from Fumes, Gases and Poisons of Manufacturing Processes" has been translated by Dr. Thomas M. Legge, H. M. Medical Inspector of Factories and joint author of "Lead Poisoning and Lead Absorption." This work includes a brief description of the industries and processes attended with risk of poisoning and the incidence of such poisoning, the pathology and treatment of industrial poisoning and preventive measures against their occurrence. Among the more important descriptive accounts are the hydrochloric acid industry, the chlorin industry, the nitric acid industry, the phosphorus industry, the sulphur industry, the illuminating gas industry, the cyanogen compounds industry and the coal-tar industry.

Another important modern treatise is a work on *Gas Poisoning in Mining and Other Industries* by John Glaister, M.D., professor of forensic medicine and public health in the University of Glasgow, and David Dale Logan, M.D., Surgeon to the Coltness Iron Works. This treatise includes observations on poisoning by charcoal fumes, on CO poisoning by furnace gas, on CO poisoning and pneumonia, etc.

Finally, reference requires to be made to a work on *Industrial Health Hazards and Occupational Diseases in Ohio*, by Dr. E. R. Hayhurst. This treatise includes a large number of descriptive accounts of factory conditions, with special reference to health and life, and a classification of occupational diseases and complaints by industries and processes. The report includes also an interesting account of 4 cases of sudden death in a silo.

There is thus abundant evidence of an increasing interest in

industrial hygiene and related medical questions of considerable practical importance to wage-earners, the medical profession and the public at large. It may safely be asserted that all the more important State health and labor departments are today recognizing the necessity for occupational disease investigations and their more qualified treatment. Trades unions are giving the matter consideration and occasionally more extended inquiries, such as those of the New York State Factory Investigating Commission, bring to light unhygienic and dangerous conditions wholly unsuspected on the part of those in charge of the plants concerned. Miss Mary Van Kleeck, in behalf of the Russell Sage Foundation, has made an investigation into the health of artificial flower makers and the conditions of labor in the bookbinding trade. The Alliance Employment Bureau, of New York, has investigated industrial art workers and case-making for jewelry and silverware. Of much value, also, are the reports issued by the cloak, suit and shirt industry of New York City and the admirable treatise on *The Longshoremen*, by Charles B. Barnes, of the Russell Sage Foundation.

Personally, I have investigated the diseases and mortality of persons employed in potteries, glassworks, plants manufacturing high explosives, coal, copper, gold, silver, lead and other mines, etc. Comparing the results of my investigations in this country with those made abroad I cannot but emphasize the obvious evidence of our higher standard of labor and life, aside from the mere question of higher wages and better housing. Whatever views may be held regarding the drink question, it admits of no controversy that habits of gross intoxication are exceedingly injurious and life-shortening. Such habits are unquestionably much more common among employees in European industries than in this country. To the extent that alcoholism is under control, the inherent occupational disease factors of a given industry assume a lesser degree of practical importance. This is unquestionably true of the pottery industry, in which the habit of gross intoxication tends decidedly to predispose toward lead-poisoning. In European countries also the condition of women and child labor are much more unfavorable

than with us. One can see—or could see previous to the war—women and young persons employed in British potteries at physical labor which would not be tolerated in this country. The higher degree of incidence of lead-poisoning in British potteries is no doubt in consequence of the higher proportion of lead used, but aside therefrom, the predisposing conditions, such as undernourishment, alcoholism, inferior physique, etc., are most important contributory factors. I merely refer to these matters for the purpose of emphasizing the importance of thoroughly qualified occupational disease investigations. Such investigations must include a careful study of essential industrial processes and labor conditions. The physician in general practice rarely has the required knowledge or interest in matters of this kind. He is chiefly concerned with the patient and the treatment of the disease from which he suffers. It is therefore urgently required that the number of qualified factory physicians should be considerably increased, for the medical supervision of large plants is no longer a duty of secondary importance. In the chemical industries, of course, a much higher degree of specialized skill is required than, for illustration, in the textile industries. A physician well qualified for a glass factory would be ill-adapted to the needs of a coal mine. The first requirement, however, is a reasonably thorough understanding of industrial and factory hygiene in their more general aspects. The practical solution of highly specialized problems is much less difficult when the general conditions of health and sanitation are well under control. In establishments where the physical examination of employees at entry is required the subsequent health administration becomes much less difficult on account of the available information regarding the health, physique and recorded disease predisposition of the men at work. The elimination of employees unfit for a given kind of labor is as much a duty as their proper compensation and adequate provision for comfort and rest. The modern American factory is one of the most creditable evidences of our civilization. If the health of our workers is above the average for European countries, and if our death rate in industry is, broadly speaking, satisfactory, it is

because of the strenuous efforts which have been made during recent years to conform methods of factory construction to higher ideals in sanitation, light, ventilation, air space, etc. Perhaps the best contrast in this respect is the old-time cotton mill of New England and the modern cotton mill of the Southern States. There is still, however, a vast field of unrealized opportunity in sanitary factory engineering. Questions of ventilation, dust removal, fume control, etc., are frequently exceedingly involved engineering problems. The treatise by Dr. Price on *The Modern Factory* may be referred to as a satisfactory introduction to an important branch of industrial hygiene, which unfortunately is only too often neglected on the part of those who are otherwise well qualified for their work.

If occupational diseases are less common in this country than abroad it is probably in part because of the fact of a larger labor turnover. Whatever may be the economical disadvantages of frequent occupational changes, there are often material benefits derived from such changes in health and longevity. Men employed at unhealthful occupations should not only be induced but they perhaps should be required by law to change their occupation from time to time. The reason why such occupations are often fatal in their consequences is chiefly because of long-continued exposure. In European countries, where trades are followed not only for a lifetime but often by members of the same family for generations, the insidious health injurious effects of certain occupations must necessarily be much more pronounced than in this country. If a man works six weeks in a white-lead plant he is not as likely to contract lead-poisoning as a man who works in such a plant year in and year out. There is, of course, the alternative of periodical medical examinations, of close medical supervision, and of unconditional and rigorous conformity to exacting sanitary requirements. When all these are complied with there is, of course, a lesser medical necessity for labor changes. Periodical intervals of rest, or vacations of sufficient length, short hours of labor, good wages, etc., all contribute toward the maintenance of health in industry even under otherwise decidedly

dangerous conditions. Occasionally, however, the only alternative is absolute prohibition of processes inimical to health. The classic illustration is the radical Federal legislation which has prohibited the manufacture of poisonous phosphorus matches. When obviously dangerous processes are prohibited a substitute is frequently found without difficulty and with the result of both increased profits and production. It never has paid, and never will pay, to undermine the health and strength of the workers even though the temporary gains may deceive the ignorant employer into believing that conformity to more or less expensive sanitary standards would seriously interfere with the prosperity in his business. There never was a time in the world's history when the economic value of labor was as high as it is at the present time and when health conservation was as self-evident a duty and practical necessity on the part of both the employer and the State. For the same reason there was never the same degree or urgent necessity for the medical supervision of industry and for the care of the health and welfare of employees as there is at the present time. All unnecessary sickness in industry requires to be eliminated as a matter of public duty and not merely for humanitarian reasons. To provide adequate money benefits in sickness under a system of compulsory health insurance would merely tend to produce a vast amount of costly malingering, and would not materially contribute toward the absolute elimination of unnecessary sickness, which is of the utmost concern to both the employer and the State. The shortening of a miner's or stonecutter's life by an average of ten years deprives the nation of the economic product of that worker's life, while an additional burden may result from a family left in want because of his premature death. The replacement of efficient labor is becoming more and more difficult and the conservation of life and health assumes, therefore, a much higher practical economic interest to the employer and the community at large. A thoroughly qualified factory physician, or industrial physician in the broader sense, should be the medical adviser of the industry as well as of all those employed therein. He should thoroughly acquaint himself with all that concerns the

health and the welfare of the employees and not merely limit his interest to the occupational diseases or the medical and surgical aspects of industrial accidents and possibly their prevention. To be thoroughly efficient he should be informed on all that concerns the employee—his leisure time, his recreation, the playground for his children, the maternity care of his wife, the protection of married women at work, the safeguarding of young people, the physical supervision of the young, the elimination of unnecessary night work, etc. In other words, the qualified industrial physician must be an expert in the whole vast field of industrial welfare, the plan and scope of which has been so admirably described by E. Dorothea Proud in a recent treatise on *Welfare Work: Employers' Experiments for Improving Working Conditions in Factories*, with a foreword by Mr. David Lloyd-George. This work includes extended observations on such questions as the "Social Function of the Employer in a Capitalistic State," the "Employers' Influence on Factory Legislation," the "Change in the Nature of Industrial Legislation; its Relation to Employers' Experiments," the "Change in the Employers' Attitude Toward Factory Legislation, Welfare Work and the Ideals of the Workers," and, finally, the "Welfare Department." Aside from the general question of the relation of work to workers, or National *vs.* Individual Points of View, and broader questions of the industrial environment, wages, and hours, etc., there are the incidental aids to welfare which, under "Physical Well-being," include health, recreation, food, baths and gymnasiums and housing, but also mental development and personal dignity.

That observations and conclusions along these lines are no longer merely idealistic or theoretical is best made evident by the appointment of a special committee on the health of munition workers by the British Ministry of Munitions, which has published a series of some twenty reports, including such important questions as Sunday labor, welfare supervision, industrial canteens, employment of women, hours of work, industrial fatigue and its causes, special industrial diseases, ventilation and lighting of munition factories and workshops, sickness and injury, investigation of

workers' food and suggestions as to dietary, statistical information concerning output in relation to hours of work, juvenile employment, washing facilities and baths, the effect of industrial conditions upon eyesight, medical certificates for munition workers, health and welfare of munition workers outside the factory, etc. Some very interesting summary observations on the munition industry, with special reference to health and welfare, are also presented in a small treatise on *Women as Munition Makers* in this country and abroad, by Amy Hewes and Henriette R. Walter, of the Russell Sage Foundation.

The industrial physician of the future, as is the case to a limited extent at the present time, will concern himself chiefly with questions and considerations of this kind. He will provide the worker with the best possible medical advice, both in the field of preventive medicine and the treatment of disease. His work will be coördinated to that of a well-kept infirmary, with a sufficient staff of visiting nurses proportionate to the number of employees and their dependents. He will give common-sense instruction in first aid and possibly home nursing. He will leave nothing undone to eliminate gradually, but surely, all health-injurious conditions from the plants in so far as these may be within the field of human control. He will insist that no person shall be employed who fails to meet the requirements, physical and otherwise, for the work to be done. He will render qualified advice regarding the proper employment of the physically impaired. He will insist upon physical reëxaminations from time to time in the case of workers employed under conditions more or less obviously injurious to health and life. He will aim persistently at the reduction of the dust hazard in all processes involving continuous and considerable exposure, especially to mineral and metallic dusts. He will have the aid of proper laboratory facilities, including urinalyses, blood-pressure examinations, radiographs, etc. He will, in brief, become indispensable to the most efficient conduct of the industry of which he will become an integral part, as much as the manager and his assistants concerned more directly with the supervision and control of productive processes. He will idealize, in brief, the highest aims

and aspirations of the enlightened modern employer or employing corporation. He will help, and help as much as anyone, in harmonizing the conflicting interests of labor and industry by eliminating the conditions which give just cause for complaint. The field of industrial hygiene is therefore one of the most promising professional pursuits of the future. It is one which will demand a high order of intelligence and devotion to duty, but there can be no question of doubt that those who properly perform their functions will have no difficulty in securing an adequate reward for their labors. It is the mission of the modern medical school to provide more adequate teaching facilities in the furtherance of this ideal. It is the duty of modern hospitals to establish occupational disease clinics in which the more obscure as well as the common industrial diseases can be treated and observed in a qualified manner. It is the duty of boards of health to insist upon the prompt reporting of occupational diseases, and the duty of every practising physician to coöperate in this respect with the authorities. It is the duty of State boards of health and of the division of vital statistics of the census to provide more adequate statistical information on the subject of occupational mortality, and last, not least, it is the privilege of the industrial insurance companies to coöperate with the State and Federal authorities in a field than which there is none perhaps of greater promise as regards its practical value to those who, by their toil and consecration to civic duty, make this land of ours a better place to live in.

You are to be congratulated on your interest in this important matter, and I sincerely hope that you may be successful in developing a practical course in industrial medicine to the highest degree of attainable efficiency.

DISCUSSION

Dr. Seneca Egbert: It would be a work of supererogation to discuss this paper after the splendid treatment of the subject by Dr. Hoffman. I look upon Dr. Hoffman as being one of the few men in this country who can speak with authority upon it; certainly, no man has had greater opportunities regarding it than he, and no man could have used his

opportunities to a better degree. I scarcely realized that he had been in the work for twenty years, feeling that the study of industrial insurance in this country was of considerably shorter duration, and I think most of us view it as a subject that has come into being—in our consciousness at least—within very recent time. The increase in social thought and in scientific consideration of matters pertaining to industrial hygiene and industrial medicine has been remarkable. It seems to me also that we are on the brink of a still greater interest and development along these lines. An editorial in one of our principal newspapers within a week was headed "Instead of Business as Usual, Business as Unusual." This illustrates the importance of efficiency in order to help on the big job in which this country is now engaged. There is no question that even when the war is ended business of all kinds must be run at the top notch of efficiency for many years to come. This is going to put a strain upon all concerned and the demands for and importance of industrial insurance will be increased. New problems due to new methods are constantly arising. The inventive genius of America is responsible for new methods which in turn leads to the necessity of men being better trained to execute high-speed work. The carelessness of one man may mean extra care, work and fatigue for others, all of which makes the problem increasingly great. I was rather surprised at the figures of 40,000,000 given by Dr. Hoffman as representing the part of the population in gainful occupations. I supposed that one-quarter of our population would represent this element. The statement is also interesting that there are about 13,000,000 to 15,000,000 cases of illness annually among the workers, one-half of which are preventable. The great opportunities of the company physician and sanitarian are here shown, for if the homes and health of the laborers are closely looked after there would seem to be less likelihood of the occurrence of "strikes." . . . Here would be opportunity also of making good citizens of the foreign born. Any one of us can appreciate the tremendous influence the physician may have in the homes of those of foreign birth. The opportunity for the physician in industrial medicine is indeed very large.

Not all illness occurring among workers is due to the industry alone. Too often there are bad sanitary conditions at home, bad habits of life, ignorance of the care of the body, etc. Frequently it is not the fault of the man but of the community, of the authorities and officials of the town. It would, however, be "up to the company doctor" to help to remedy these faults. Those of us who have seen the literature on the subject develop rapidly and have read some of the text-books have some slight inkling of the changes made in the industrial working conditions. I am very glad to hear of the change from the old-time New England

factory to the one of the present. We should note the progressive action of the big corporations today in doing all that they can in providing not only physicians for their workers, but hospitals and many other lines of service. These provisions are made not alone to save the workmen for themselves but for the welfare of the men. Here the physician can do much, for with the best of intentions on the part of boards of managers and trustees, final resort must be made to the physician for his knowledge and advice regarding the introduction of improvements in the factories benefiting the worker.

Those of us not directly in this work have some caution in the use of our statistics, remembering that our data at present are more or less incomplete, and that unless we have such complete information as that secured by Dr. Hoffman or Dr. Alice Hamilton we shall be misled.

Much attention also has been given in recent years to child labor and to the protection of women in the occupations. Most of us do not realize that the first child labor law in this country was passed in New York as late as 1886. In Pennsylvania, the latest advance, the continuation school, dates from 1915. We must appreciate that it is up to this country to do what has been done abroad in the care of the woman immediately during and after the time of confinement. During this period of several weeks she should have cessation from labor, with full wages, as is done in Switzerland. We must remember that such protection works for the welfare of the country as well as of the individual. Much more might be said upon this, but it seems to me that we have a tremendous opportunity the whole of which we do not as yet fully appreciate.

Dr. Hoffman (closing): At the outset I wish to emphasize my grateful appreciation for the splendid address of Dr. Landis, which clearly illustrates the encouraging progress we are making in this country in the direction of thoroughly specialized and strictly scientific investigations into this large and important subject. I am thoroughly familiar with the work of the Phipps Institute, since I have the honor to be on its Advisory Board, and I may say here that if the Institute had done nothing else than to carry through its investigations into the health and labor conditions in the clothing trades and the potteries the expense incurred would have been well worth while. Dr. Landis differentiates very clearly between the pathological effects of inorganic and organic dusts. Such a differentiation, unfortunately, is often not made where it is of the first importance. In a forthcoming bulletin of the United States Bureau of Labor Statistics, on the relation of dusty trades to respiratory diseases, I give separate consideration in the first volume to occupations with exposure to inorganic dusts. As I recall it, the investigation includes

over one hundred special trades and occupations, and I may say, with reference thereto, that the original title of "Tuberculosis in Relation to Dusty Trades" was changed to "Respiratory Diseases" because of the very facts to which Dr. Landis has called attention. I, of course, could not possibly hope to cover the field as thoroughly as he has done, nor with the required degree of medical and other scientific ability, so that I cannot do better than repeat my sincere personal appreciation to Dr. Landis and his associates for the many valuable suggestions which they have made to me and which I hope to be able to incorporate in my forthcoming volume on the subject, which is now in course of final revision.

Whether it would be possible for me to carry out my original intention in regard to a supplementary volume on occupation in exposure to organic dusts is rather doubtful. I am confronted with the many practical difficulties to which Dr. Landis has drawn attention. The literature of the subject has been materially enlarged since my first observations were published, about ten years ago, and many of the industries and industrial processes have undergone profound changes in the direction of efforts aiming at more successful control of the dust problem. The field of research indicated by Dr. Landis is, however, well worth while, and perhaps best illustrated by the cement industry, which has been the subject of widely conflicting views as regards its relation to health and life. I was rather surprised at the statement by Dr. Landis of such a considerable accumulation of cement dust in the lungs during so relatively short a period as five years, but much would depend upon the precise occupation of the employee. Without proper control the dust problem in the cement industry is perhaps the most serious met with anywhere, but fortunately the pathological consequences of such exposure are apparently less dangerous than in occupations with exposure to many other forms of mineral dusts. The view is held by Dr. Tucker and others that, because of its soluble qualities, the inhalation of cement dust is relatively harmless and not a predisposing cause to pulmonary tuberculosis.

Dr. Estes referred to a matter of some importance to me personally, and that is the European museums of safety and sanitation. It seems to me but right and proper that some mention should here be made of the fact that in this country we have a well-conducted museum of safety in the city of New York, which, if more adequately supported, would, within a reasonable period of time, outrank any European institution of its kind. I have visited the principal museums of safety in Europe and I have been on the Board of Trustees of the American Museum of Safety practically from the date of reorganization. The museum has an impressive collection of practical safety devices and wax models of occupational diseases, all of which reflect the generosity and interest of those who support the institution. Unfortunately the museum is not well located, and

while it is reasonably well known to those connected with large industries, it is rarely visited by those who would most benefit by the exhibits, which are open to the public free of charge. The museum meets numerous requests for information by correspondence through its research department, and since the outbreak of the war it has been of invaluable assistance to the Government by the loan of its director through the United States Employees' Compensation Commission in the working of a standard plan of safety organization and the adoption of approved safety devices in Government plants and Government contracts. The museum could easily be made more valuable to the medical profession if a more hearty degree of coöperation were extended to it, especially in the direction of pathological specimens, reprints of papers on rare occupational diseases, exceptional accidents, dust samples, etc.

To those who desire to pursue the subject of dusty trades in a more highly specialized form it may be suggested that they consult the Milroy Lectures of 1915, on "Industrial Pneumonoconioses," by Dr. E. L. Collis. Another recent evidence of strictly scientific methods applied to the subject is the general report of the Miner's Phthisis Prevention Committee of the Union of South Africa. It is to be hoped that in course of time we shall conduct similar investigations in this country, and as a promising indication, reference may be made to the adoption of a resolution by the National Association for the Study and Prevention of Tuberculosis, appointing a committee on the scientific study of the dusty trades, limited at the outset to persons employed in the various branches of the stone industry. It is regrettable that the investigations initiated a few years ago by the Mellon Research Institute of Pittsburgh, in reference to the relation of smoke to health and disease liability, were not carried forward to a really successful conclusion. The basis, however, was laid for a future scientific study of the important question of anthracosis, than which there is perhaps no affliction of more serious importance to those exposed to the continuous and considerable inhalation of coal dust or coal smoke.

In conclusion, I may reëmphasize my earlier suggestion that the work which requires to be done needs the coöperation of the entire medical profession, but the more involved methods of scientific research can only be successfully carried through by a small and carefully selected group of men who, like Dr. Landis, have given many years of thoughtful consideration to the subject. There is nothing more deplorable than the ruthless waste of manhood and womanhood in the industries of this country because of unfavorable health conditions, which, in the light of modern knowledge, are largely matters of prevention and control. All efforts at the solution of the problem of the dusty trades in relation to health must bring the larger question of tuberculosis prevention and control nearer to the point of practical solution.

Compensation Laws the Potent Factors in the Prevention and Treatment of Occupational Diseases and Industrial Accident

BY W. L. ESTES, M.D.

It is generally known and it soon will be scientifically proved that the environment and the conditions of work places (mines, factories, shops, etc.) produce many diseased conditions and that certain of these diseased conditions are especially prevalent in some occupations.

At least two hospitals in the Eastern States have organized clinics to study occupational diseases. The pioneer, so far as the writer knows, was the Massachusetts General Hospital. Quite recently the University of Pennsylvania has also taken up this work.

The reports of these clinics are most interesting. The suggestions which undoubtedly will come from these investigations will result in the amelioration of many of the evil conditions to which industrial workers are exposed, and they will bring about the organization of methods and means to prevent many of the prevailing diseases.

The special investigations are too new and the material and facts are not yet sufficiently large and well digested to base positive conclusions and recommendations upon them. Nevertheless, it is safe to predict, from what is already known, that before many years occupational diseases will form a chapter in all comprehensive systems of medicine and will be as distinct and important as tropical diseases now are.

However, the object of the paper this evening is to call attention to the marked changes for the better in the sanitary, hygienic and security precautions taken by manufacturers in the last few years for the safeguarding of their employees and the results and sequences of the workmen's compensation acts.

It was for many years in the stress and drive of active competition and the organization of new industries, a very difficult

matter to induce the owners and managers of industrial establishments to believe that it was worth while, in the sense of efficiency, to conserve the health and strength of their employees even if it did require an added expense both in overhead charges and working calculations. Besides, the constant inflow of immigrant labor supplied an adequate force to renew the defections of the sick and injured employees.

It was only in the last decade and a half that a few establishments made some small provision for the sanitation and comfort of their employees. They were at first astonished to note that the efficiency of the force and the quality and quantity of the production actually increased. The morale and physical condition of their employees were also markedly benefited. With these examples scattered over the country as object lessons manufacturers generally were too ignorant or too indifferent to heed the lessons of the success of the methods. So no general acceptance and practice of the improvements followed.

Since the passage and enforcement of compensation laws in thirty-seven States and Territories there has been a marked change.

The human mind seems disposed not spontaneously to grasp, certainly not to apply, sanitary laws to the betterment even of its own conditions. Men generally think very little of hygiene when they themselves are well.

Industrial establishments have hitherto been organized primarily for making money. If by chance they turned out a product necessary for the happiness and well-being of their fellow-men this was good in so far as the very fact of the usefulness and comfort of the product created a steady demand in the markets and kept up the price of the commodity.

It seemed at first to manufacturers a far cry to increased production through the medium of the well-being of their employees and the expenditure of thousands of dollars for the sanitation and welfare of these people. The deductive philosophers may deny that all knowledge is based upon experience, but they cannot deny that all practical (every-day working) knowledge is based on experience.

It was necessary that manufacturers should by their own or by someone else's experience be taught the value, in every sense, of taking measures to safeguard the life and health of their employees. Especially was it difficult for them to learn that measures for the comfort and ethical culture of their employees was a stimulation to production. A few did learn these important facts. A very few put them into practical use and prospered. The others too careless and indifferent kept on in the old way.

Another important fact was brought out by the sporadic attempts of employers to improve the condition and safeguard the lives of their employees. This was that the employees seemed not to care for the consideration and would not use the comforts and appliances for conserving their welfare.

Evidently where the two classes of people directly concerned are too ignorant or too indifferent to employ measures of sanitation and general welfare it was necessary for the community generally to step in and to teach the necessity of employing measures to conserve the health and lives of its constituents.

Thus it came about that systematic efforts were made to educate people, both employers and employees, in regard to measures of sanitation and welfare.

The countries of Continental Europe were far ahead of the United States in organizing museums of safety and such like graphic methods of teaching people ways of conserving efficiency and life.

Results through education of masses of people are very slow "to arrive." After a certain degree of enlightenment has obtained and a chosen few are convinced of the necessity or good of certain social practices it is much quicker to arrive at results by legal enactment than patiently to carry on the educational campaign for the many years necessary to convince the majority of people.

One must admit, of course, that in a democracy it is usually necessary "to educate the people" up to a certain degree of knowledge for conviction and support. This is true, however, of only a small minority of people. Convince and get the support of comparatively few forceful people and it is nearly always possible to lead the majority to a vote without either thorough knowledge

or conviction. Thou shalt and thou shalt not from Moses to Woodrow Wilson have far more effect than it has been determined by experiment that it is best to do or not to do.

It followed therefore that before the statutes of the several States were passed requiring some sanitary precautions and safeguard for workpeople measures were only sporadic, employed by comparatively few establishments and wholly inadequate.

It was not until manufacturers and employers generally were made liable in money for the welfare of their employees that anything like a general and complete system of safety measures were employed.

Evolution is such a slow, quiet process that it is almost impossible to trace back to the very start the educational beginnings which finally led to the compensation laws of the several States of the Union. Undoubtedly the examples of Germany and England had much to do with them.

The first compensation law was enacted in Germany July 6, 1884. This law was amended and expanded from time to time until the year 1911, when all the provisions of the various laws were united into one act. Owing to administration changes and various hindrances due to the social insurance law features the actual enforcement of the code of 1911 did not come into effect until January 1, 1913.

The earliest British Compensation Act was adopted in 1897. After several amendments, notably those of 1900 and 1906, practically the whole working part of the act was incorporated and made a part of the comprehensive Compulsory Health Insurance Act which came into effect in July, 1912.

That sociologists were working along the lines which were to lead to our own laws was evidenced by a number of beneficent laws passed by the Legislatures of nearly every State in the Union ameliorating the working conditions in mines and factories; but all of these laws antedated the first compensation law in the United States but a very short period. In 1911 Massachusetts, Wisconsin, New Jersey, Kansas and Washington enacted Workmen's Compensation Laws. Following along each year thereafter (including

this year, 1917), other States have enacted compenation laws. Now there are thirty-four States and three Territories which have these laws.

The general features of all these laws are beneficent as regards the workmen themselves, as they all require payment for disability and death of workmen injured while at work without any question of contributory negligence; thus assuring the people directly concerned their legitimate rights without recourse to lawsuits for settlement.

Already the actual saving of life and disability have been remarkable from the protecting devices, supervision, educational methods and care brought about by the compensation laws.

Mr. Will J. French, in a paper published in the *Proceedings of the Conference on Social Insurance*, December, 1916, gives the following data from California under "Industrial Deaths Reduced."

"The Industrial Accident Commission has issued figures giving the number of deaths in the industries of California during the year 1915 and draws attention to the list as compared with the statistics of 1914. In the latter year there were 691 workers killed and in 1915, 533 workers gave their lives to the industries of the State. The following table shows the reductions in the death list by occupations (the word 'service' includes employees of men in the professions, as well as those engaged in hotel service, apartment houses, restaurants, domestic servants, and amusement or entertainment employees):

	1915	1914
Agriculture	55	62
Construction	78	115
Extraction (mining and quarrying)	71	86
Manufacturing	99	121
Service	25	24
Trades	20	24
Transporation and public utilities	172	239
Unknown	13	20
Total	533	691

"This effective work in behalf of 'safety first' has been accomplished as a result of cordial support from employers and employees, the public generally and the press of California. It is a striking

result to be able to show a reduction of 158 in the death roll of 1915 as compared to 1914. That this reduction comes as the result of careful planning is shown by the decrease in the main industries of the State, excepting 'service,' where the record shows an increase of one death in 1915 over 1914.

"It is the hope of the Industrial Accident Commission that statistics will show a substantial reduction for each succeeding year. The aim is that no preventable death shall take place. The 158 lives speak in terms of breadwinners saved to wives and little children and an enrichment to the State's citizenship."

The reports of other States are not at present at hand, but in every report a saving of life is shown and the period of disability is markedly reduced.

The indirect effect of these laws are of far more importance sociologically and are far-reaching in their ultimate consequence. It is to these features I wish now to call your attention.

As employers are obliged by the laws to pay indemnity for disability of persons injured while in their service it followed, as a matter of course, that it would be of tremendous importance to know whether all the employees were physically fit for their special work. If for any consideration, such as special skill, long service or humane sentiments, the company was willing to waive this privilege in case of the men already employed, certainly they would not do so in regard to new men. This led to the requirement of physical examinations of workmen and systematic medical supervision of employees.

Systematic examinations of workmen have proved so important to the companies and have revealed so many interesting and important facts that the provision is almost universal now in well-managed establishments. The side lights of this subject are so many and of such deep interest to employers and physicians as well as to all communities of an industrial character that many evenings might very profitably be given to their discussion.

Dr. W. Irving Clark, medical director, of Norton County, Worcester, Mass., in a paper read at the Conference on Social Insurance, Washington, D. C., December, 1916, sums up the

advantages of "Physical Examination of Employees as Generally Employed by Industrial Establishment" at the present time, as follows:

"MEDICAL SUPERVISION. Medical supervision begins as soon as an applicant for position becomes a member of the factory force. As we have pointed out it begins during his physical examination and it continues until he leaves the employ of the company.

Medical Supervision consists in—

1. Reëxamination of defective workmen at varying intervals.
2. Reëxamination of workmen transferred from one department to another.
3. Examination and advice with simple treatment in all cases of sickness.
4. Prevention of contagious disease by its immediate isolation when discovered and by prophylactic inoculations and other measures.
5. Immediate treatment of all cases of accident occurring in the factory.
6. Subsequent treatment of all accidents occurring both in and out of the factory until the patient is able to resume his duties.
7. Supervision of sanitation.
8. Health publicity through monthly leaflets distributed in the pay envelopes.

SUMMARY. And now let us consider briefly what all this means. It means first that by a comparatively small expenditure the factory obtains men physically fitted for their work, men supervised medically, so that they are kept in the best physical condition, men who will be absent from work for a minimum time when injured or sick.

It means contented workers who realize that the factory takes a personal interest in their health and well-being.

It means a reduction of sickness in the community.

It means a minimum of permanent disability and rapid return to work after accident.

It means a quick prevention of the spread of contagious disease.

It means better and more hygienic working conditions.

It means a reduction and prevention of occupational disease.

It means a constantly increasing knowledge by workers of simple rules of health and prevention of disease.

If universally adopted it would mean a physically and mentally better country. The sinews of production ever strengthened and guarded, the factory would cease to be considered a consumer of human lives, but would be considered rather as an educator and supervisor of health.

Preparedness is the watchword of the day. Can we better prepare for our industrial future than by urging the medical supervision of factory employees?"

Medical supervision in many large industrial companies has been organized as a part of a regular "Department of Safety and Welfare." These departments of safety and welfare are usually well organized under a wide-awake layman as superintendent or director, with an adequate corps of medical and other assistants, etc., under him.

The safety departments not only see to the purchase and instalment of safety devices in the works but employ supervisors who constantly patrol the mills to see that the contrivances are actually used by the workmen.

Also the department gives regular courses in hygiene and sanitation and first aid to the employees.

It oversees the water supply, the sanitation and generally well-being of the employees while at work, and furnishes baths, sanitary towels and drinking cups or drinking fountains for their people while at work. Also regular dressing stations are established at convenient places in the works where injured men may be taken for efficient first aid. A number of large establishments have well-organized, well-equipped and well-manned dispensaries or small hospitals within the works where efficient dressings may be done and then the cases are distributed to outside (base) hospitals as the nature of the injuries require.

It is interesting to note some of the results already accomplished.

From the report of the Executive Committee of the United States Steel Corporation to the stockholders in 1916 the following

is a very interesting indication of what this great corporation has done for its employees:

"The work done by the subsidiary companies in prevention of accidents, improvement of sanitary conditions and in many other ways of bettering the conditions of their employees has been continued with energy and persistence throughout the year. Most of the important plans were begun in earlier years. In 1913 these plans, which had previously been applied successfully in some of the companies, were extended to all the companies; all this work was systematized and more of the plants and mines were brought up to the highest standards as a result. This work is today more highly organized and effective than ever before.

"Our accident prevention work has reached a high point of efficiency. Nevertheless, experience and careful observation suggest improvements from time to time, and they are promptly made. Effort is now being directed toward teaching the workmen habits of caution, making watchfulness against dangers to themselves and their fellows a matter of constant attention. It has been necessary to overcome recklessness and disregard of dangers which had come to be treated as customary risks of the trade against which the men would not take any precautions: to teach them that taking risks will not be permitted.

"The cost of safety work in 1913 was $660,593.

"Serious accidents per 1000 employees are now 38.25 per cent. less than in 1906, when this work was first taken up by the United States Steel Corporation. This means that 2273 men, who might have been injured under earlier conditions, were saved from serious injury during the year.

"In sanitation many improvements have been made in the proper investigation and observation of water supply and distribution to the men. All sources of drinking-water are analyzed periodically. Great care is taken against possible pollution. The most modern and sanitary methods are used in the proper cooling and distribution of water, including the sanitary drinking fountain. The common drinking cup has been practically eliminated. The investigation of water supplies and the installation of drinking-water systems alone cost $130,000 during 1913.

"The common or roller towel has been abolished. Wash rooms, shower baths and lockers, started in earlier years, have been extended. During 1913 there were installed 1193 wash basins, 210 showers and 15,471 lockers. Two additional swimming pools for general use in the mining towns were built during the year. The cost of providing washing facilities for 1913 was $141,000.

"The total cost of sanitary work during the year was $564,977.

"In welfare work of a character not covered by the plan already mentioned for benefiting the workmen our companies have tried many interesting things. They now maintain in the populous districts around their plants 101 children's playgrounds, with an average daily attendance during last summer of 8688 children. At a number of the plants visiting nurses are available.

"The aggregate expenditures during 1913 for improving conditions among workmen of the United States Steel Corporation were as follows:

Relief for men injured and the families of men killed which is paid in all cases, regardless of legal liability	$3,013,638.12
Accident prevention	660,593.84
Sanitation and welfare work	1,600,242.69"

In answer to a personal letter I am permitted to quote the following from a communication sent to me by the head of the Department of Labor and Safety of one of our largest corporations in the United States.

"Answering your questions in the order they are asked I beg to say:

"1. The percentage of serious accidents per 1000 men employed has been greatly reduced; the reduction effected during the last three years amounts to 35 per cent. over the period of three years previous. The number of minor accidents reported is materially increased since the organization of this department, for the men are constantly urged to report to the dispensary every scratch and bruise, no matter how slight it may seem, in order that the doctors may be assured that the wound is given proper treatment, as where formerly many minor injuries were neglected, with resulting infection and increased loss of time.

"2. Accident cases are handled much more intelligently at the present than ever before, due principally to the fact that a highly refined system of departmental safety committeemen has been instituted. These committeemen have been put through a course in first aid, and when an accident occurs are on hand to render the necessary assistance in arresting flow of blood, giving stimulants, making the patient comfortable and providing for his transportation to the company's hospital, where expert surgical aid is given. It has been found that prompt attention by a trained man on the scene of the accident has been the means of saving much suffering to the victim, and in some instances saving his life.

"3. The period of disability has been reduced, due to a systematic investigation of each case and a determination of the period to be allowed; furthermore, a man is not permitted to lay off from work without written permission from the dispensary, and since every case must report to the dispensary, no man is able to get out of the plant with an injury, or to lay off without the department having the information.

"4. The department has saved money for the company, inasmuch as a reduction in the period of disability saves money for both the Company and for the man.

"5. The spirit of the men toward the company is much better at the present time than ever before, because they realize that the company is providing for their welfare by the establishment of the sanitary lockers and wash rooms, a splendidly equipped dispensary and various forms of recreation, such as the soccer team, baseball team, basketball league and the maintenance of an athletic field and gymnasium and field house.

"The company also takes active steps to have adequate transportation facilities provided, and will furnish financial aid to a man who is desirous of building a home in this community.

"6. Of all the accidents which occur it is fair to say that fully 75 to 80 per cent. of them are directly due to the carelessness of the individual employee or his neighbor in the shop. The percentage of accidents for which the company could be charged with contributory negligence is indeed very small compared with those caused by some direct violation of safety rules, or indifference."

These quotations very plainly show the tremendous advances in caring for the employee and the good accruing to the workpeople and to the establishments themselves.

The effect in the community is also a matter of very great importance:

1. The pecuniary value of a large body of healthy prosperous men to the community in which they live is one of very large proportion.

2. The prevention of disease and the immediate and skilful treatment of ailments and injuries save the community from many outbreaks of communicable diseases and restore its citizens to full productivity, with minimum loss of time.

3. The moral effect of a large body of healthy, contented and prosperous men and women in a community keeps the tone of the people generally on a high level and encourages enterprise and efficiency in all walks of society.

4. The educational value to a community is almost inestimable. The workpeople are taught the elemental principles of hygiene and sanitation and how to render first aid to injured persons, and they carry this knowledge and practice to their homes and extend it to their neighbors.

It is evident therefore that the necessities of the systematic practice of an organized safety department brought about by the Compensation Laws may create a new era in the history of our country, and, as was said before, will lead to results of far-reaching character.

But is there no obverse to this beneficent picture? Are all classes of the people equally benefited?

Lawyers claim that their practice has been appreciably reduced. This is very probably true of lawyers whose incomes depended chiefly upon the successful result of what was formerly aptly called "ambulance chasing." Society will be benefited by getting rid of such legal talent, and it will greatly improve the character of the men who formerly lived chiefly by encouraging speculative law suits. It will hardly affect in any way the practice of legitimate jurists.

Another class of a community vitally concerned is the physicians.

The writer has been under some pains to investigate the effect of the compensation law upon physicians in our State.

The result of this investigation has been published in two papers read on two former occasions.[3]

The investigations by personal letters, interviews and individual and collective discussions, privately and in various assemblies, showed that physicians believed the Pennsylvania State Workmen's Compensation Law in the main a good one and that in itself it would rather benefit than injure the business and standing of physicians. But a very large number of the profession pointed out the evil effects which must necessarily follow to physicians from the common practice of insurance companies.

One clause of the Compensation Law requires employers to ensure the payment of compensation in some insurance company unless they cannot show their financial ability to pay any probable amount of compensation which their employees would require. Very large and very strong companies generally elected themselves to assure payment of compensation. The very large majority of industrial concerns insured payment in some outside company.

Naturally all insurance fees to physicians were based upon the clause in the law which prescribed a liability period of fourteen days and a maximum payment of $25 for physician's fees without operation and the maximum fee of $75 for an operation fee.

Practically all the insurance business of the State under the Compensation Law is in the hands of less than a dozen companies. Each of these companies must have a physician to make examinations for it. Large corporations have their own physicians.

It is greatly to the interest of the corporations to have well-qualified and experienced physicians. They are willing and do pay respectable remuneration to their incumbents. It is quite a different matter with the insurance companies. They are in the business to make money and they secure the services of a physician at the lowest possible cost. It happens therefore in an industrial community that the examining and generally the treatment of persons who come under the provisions of the Compensation

Law fall into the hands of a selected few men, and many of the other members of the profession in the community find they are deprived of clients who had been unquestionably theirs for many years. The outcome seems to be, therefore, that this feature of the law brings increased practice but to very few physicians in an industrial community.

The further effect is set forth in one of the papers by the writers mentioned before, and with your permission the following is quoted as summing up the sentiment of physicians of the State and the conclusion drawn from it.

"Practically every physician of the State agrees that the amount and time of remuneration for physicians are inadequate. If their whole practice were confined to this class of cases they would find great difficulty in supporting their families. But just as artists must accept very low prices for the pot-boiling productions of their brushes in order to keep a little ready money for some of the daily wants of life so physicians are also forced occasionally to accept inadequate and altogether humiliating fees because they are fairly certain to be paid with much more promptness than their usual clients pay. It is not true in this case that he who pays quickly doubly remunerates. All concerned in this unfortunate state of affairs should bear in mind, to continue the illustration, which seems quite appropriate, that the artists in producing their pot-boilers have little thought for the special scheme of their work; they are frequently commissions, that is to say, contract jobs, to produce a suggested object in a certain way for advertisements or illustrations. In short, they are mechanical productions. Just so it is and must be with the contract work of physicians. They feel that it is humiliating work, done for extremely inadequate fees, and restricted by directions or rules of a company; naturally the quality of the service if originally good, will deteriorate until finally the service is as cheap as the payment is small. This, as it were, unfrocks the physician, lowers his self-respect and engenders habits of rapid, slovenly practice which will soon wreck his career as an up-to-date scientific practitioner.

It is particularly bad for the poor patient who will receive the

unskilful and mechanical treatment which will prolong his suffering and disability, perhaps result in permanent disablement for which there was originally, from the nature of his injury, no good reason.

It is also bad for the employer, as it leads to much longer disability and perhaps to the extreme length of time allowed for compensation.

It is bad for the community. A physician who has lost his self-respect and his habits of careful examination, diagnosis and skilful treatment serves as a deteriorating influence upon all who come in contact with him. It takes away the influence of many individuals therefore from the uplift of scientific work, skill and thorough efficiency. A community which pays cheaply for service usually gets that kind of service, and this cheap influence pervades and finally dominates the whole region. From little, little may be expected.

Bearing all this in mind, thoughtful physicians have been trying to find a solution of the difficulty. A commission of physicians representing every branch of the legalized practitioners of the State was organized to propose definite suggestions for amendment to the law.

After careful consideration and consultations and conferences with the Workmen's Compensation Board these recommendations practically concentrated on the two suggestions, namely: (1) extend the period of direct compensation of physicians from fourteen days to thirty days, and (2) increase the maximum compensation for treatment from $75 to $200.

If one carefully considers the law and has had experience in its practical working he will almost surely conclude that if these two recommendations should be embodied as amendments in the law without any restrictions or qualifications the other disagreeable features and difficulties could easily be resolved.

Another matter which physicians must insist on, which comes as a direct result of the requirement of insurance of payment to the workingmen, is to see to it that every insurance company agrees to pay its physicians for their services the same rate of fees these physicians are accustomed to ask and to receive from their other

patients of like standing in the community. This must come from organized effort of physicians through their city, county and State medical societies.

The legislators and administrators of the laws of our commonwealth should bear in mind that whatever legal enactment tends to lower the dignity and efficiency of any class of citizens of the State must of a necessity affect the whole people.

Conservation of efficiency is one of the cardinal ideas of the Workmen's Compensation Law; this idea should extend to the service of all the people and not to one class alone.

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DISCUSSION

Dr. Lida Stewart Cogill: It seems to me too bad that in the splendid papers of the evening no mention was made of one of the most potent factor in industrial diseases and accidents—alcohol. I believe that statistics show that 35,000 deaths each year in the industries are supposed to be due to alcohol. I think the industrial world is agreed that alcohol is largely their enemy in an economic sense at least.

Dr. J. C. Foltz: I should like to ask Dr. Estes whether he has made any study of the number of accidents in those found to be subnormal upon examination. My experience is that the greater number of accidents occur to the subnormal person.

The reverse is therefore true, that if they are examined before placing, many accidents can be avoided.

Dr. Estes (closing): I cannot say that we have made any studies specifically upon the proportion of accidents which occur to the sub-

normal. Dr. Foltz is quite right in his supposition that men showing abnormalities, whether mental or physical, are much more apt to receive injuries; also, they are likely to bring about injuries to their fellow-workmen.

In reference to alcohol, I have, I think, statistics to show that men who habitually use alcohol are especially liable to be injured; also, that men who do not use alcohol but who are working beside the men who do are apt to be injured. Men coming from certain parts of Austria are in the habit of taking whisky before they go to work, either at their homes or on the way. Near a mill with which I am thoroughly acquainted there are many grog shops just outside the entrance to which the men go and take their drinks on their way to work. I have noticed that men in the habit of doing this have often, in about four hours, been brought into the hospital with an injury, or that men working beside them have been injured.

Again, fatigue has a tremendous effect in the incidence of injury. Men working over hours are very apt to receive or to cause injury. So that these factors—abnormality, alcohol and fatigue—have a marked effect in producing injury.

Pulmonary Changes Produced by the Inhalation of Inorganic Dust

BY H. R. M. LANDIS, M.D.

The subject of dust disease of the lungs occupies a rather unique position. Every text-book has chapters on pneumoconiosis. Everyone knows that it is a disease of the lungs produced by the inhalation of dust. One may search the morbidity and mortality statistics but will never see the condition mentioned. There is therefore no way of determining how many people are suffering with the disease. Confusion has arisen from the absence of distinction between organic and inorganic dust. There has been recently, however, a disposition to make such differentiation. Dr. Hoffman tells me that in the revision of his work on the influence of dust upon the lungs he has made a very distinct separation of inorganic and organic dust. We know a great deal about inorganic dust but relatively little about the organic form. There

is no proof that organic dust produces any pathological condition in the lungs. Whether it acts as carriers is another question. We have ample proof of the changes made in the lungs as the result of inorganic dust. We studied the effect of the coal dust in its most obnoxious forms. In one case the lungs of a child were laden with soot, as is seen in Pittsburgh. The changes occurring in any form of inorganic dust are exactly the same, varying only in the particular that the mildest changes are seen in the coal dust; the process is usually extremely slow. In South Africa, among the silica miners, large quantities of silica dust are found in the lungs. The worst places with which we had anything to do were the cement factories. The amount of dust was intolerable, yet the men were of extraordinarily fine physique, robust, strong, healthy men with no complaint whatever. There were no respiratory symptoms and the men had been employed under these conditions for from five to fifteen years. In a few cases only, after being subjected to this dust for from five to ten years, was there any evidence of trouble. Dr. Pancoast had two radiograms made illustrating this very well. One man subjected to coal dust had a moderate involvement of the lungs. One man working underground for years had a fibrosis of both lungs, with marked distortion. These pathological changes are extremely interesting, checking up as they do with the radiographic findings, barring the first stage which, of course, is practically negative on the plate. The solution, I think, lies in the fact that the area is at first protected by the ciliæ of the outer respiratory tract. Gradually these defences break down and the small particles of dust are taken up by the lymphatics and appear in the alveolar cells, the first histological change noted being the swollen alveolar cells. Other changes are marked swelling of the cells lining the alveoli, with marked pigmentation in the alveolar walls in and about the bronchial walls. Deposits of dust seem to localize at the junction of the lymphatic channels. The cut surfaces will show this in the gray parenchyma of the lung. This represents the stage of pneumoconiosis, and with the definite deposit of these small points of dust one begins having a marked inflammatory condition of

fibrous tissue. The fibrous tissue and the dust alternate; the points coalesce and ultimately there is a large fibrous mass. The various changes that take place in the diaphragm represent one of the most interesting phases pathologically. From the preventive side the changed conditions represent most interesting factors regarding the disease itself. A man may have definite changes in his lungs from the inhalation of inorganic dust, but if he cease his employment the changes do not progress. This was shown by the work of Wainwright and Nichols in 1905. Having examined men employed for five to ten years they made occasional radiograms of the chest and could definitely tell how much damage was being done. A curious phenomenon is that out of 100 men subjected to the same dust conditions the same results are not found. The men react to the dust particles as they would to infection by given bacteria. Why this should be so in inert substances we do not know. Some men have the most extensive fibrosis. In one man employed in a pottery I was amazed to find his lungs but slightly changed. Other men working in the same shop for the same length of time showed very extensive change.

In the dust with which we have had experience, examination of the men will detect nothing. This is true in the vast majority of men employed about ten years; beyond fifteen years one observes physical signs varying in accordance with the amount of pathological damage done. Dilatation of the bronchi takes place more frequently at the apices of the lungs rather than at the bases.

Tuberculosis is constantly confused with dust disease. In my work at White Haven, six years ago, a number of patients from the Trenton potteries came under observation and were shown to have diffuse bilateral fibrosis due to dust inhalation. None had been employed for less time than ten years; most of them had been in the work for thirty to forty years. No doubt a large number of cases are recorded as tuberculosis which are not. The symptoms and physical signs mimic advanced tuberculosis so closely that no human being could detect the difference without examination of the sputum. I have under observation at this time two patients, one with tuberculosis and the other without, yet the physical signs

are almost identical. When tuberculosis becomes engrafted on these latent cases it runs a more latent course.

I have in mind one man, weighing 130 pounds, in whom tubercle bacilli were found and a definitely marked lesion. To my utter surprise that man some time afterward walked out of Dr. Pancoast's laboratory weighing 200 pounds and absolutely free from any symptoms of tuberculosis, but had the evidence of an old healed lesion. He had gone back to Trenton, but not to the potteries until later, being attracted by the pay to skilled workmen. He is one of some five or six men who developed tuberculosis while in active life and who after recovery went back and stood the work well. My own belief is that these men acquired tuberculosis as others do. The arrest of the disease I am willing to believe is due to the considerable formation of fibrosis in their lungs rendering them resistent. Everybody at the present time believes that tuberculosis is healed by formation of fibroid tissue. It is perfectly obvious to my mind that the lung already fibroid is going to be more resistent, and even should the lung become tuberculous the disease runs a retarded course. Wainwright and Nichols believe that tuberculosis is relatively uncommon among coal miners. Klotz, of Pittsburgh, is of the same opinion and believes that the fibrosis from the inhalation of soot is a certain protection, but not curative.

Our results from this study during the past year were all checked up by Dr. Pancoast's radiographic pictures, and Dr. Smyth has some interesting figures on the study. One very interesting experience was the coöperation shown by the manufacturers. They sent down to us as many as fifty employees for examination, paying their expenses and day's wages. The cement manufacturers say Bethlehem did the same thing. He had found from the dust analysis that they had been wasting a certain amount of cement and has since installed an apparatus which has been of economic value in preventing such loss.

DISCUSSION

Dr. Henry K. Pancoast: From a personal stand-point this work was taken up in an effort to study certain features in connection with the interpretation of evidence of pulmonary tuberculosis, and especially the linear markings found upon most roentgenograms, but which vary to a considerable extent without any apparent pathological reason. These variations have been explained to a large extent in our study of pneumoconiosis. It is true, as Dr. Landis has said, that the roentgenogram follows the pathological findings. Three distinct stages of the condition are to be recognized from the roentgenological stand-point: (1) That in which we find corresponding to the deposit along the bronchi and in the hylus a great increase in the hylus shadow of the lung on each side and in the linear markings, particularly those that run to the bases and undue presence of the linear markings running in all directions. Usually the increases are uniform, as a rule. These findings sometimes make it difficult to distinguish between pulmonary tuberculosis and pneumoconiosis, especially when not uniform, and undoubtedly many cases have been diagnosed tuberculosis which are really pneumoconiosis in the first stage. In the second stage the deposits are farther out in the lung structure, and as localized fibrosis forms around them the so-called "spots" begin to show in the plates. In the early stage this will depend to a large extent upon the character of the inorganic dust. Pure organic dust does not seem to play very much part in pneumoconiosis. Metal workers showed the deposit far out in the lungs earlier than others, and it was dense because of the density of the metal. This is the typical stage recognized so long in roentgenology. The third stage is the end-result, and in it the roentgen appearance may again be mistaken for tuberculosis. It is difficult to determine by the roentgen examination just how the transition occurs: whether there is conglomeration of small areas of mottling or whether there is a diffuse fibrous process involving a large portion of the lung structure. It may occur in both ways, and probably does. In late stages bands are formed which limit the diaphragm excursion; cause cavities and emphysema; the heart and vessels may be drawn to one side. The studies of the diaphragm are certainly very interesting. Limitation of the diaphragm begins very often, not always, in the very first stage when there are fibrous changes and thickening along the linear markings running to the bases, and this seems to interfere with the elasticity of the lung. The most marked limitation is usually seen on the right side. Early limitation of the diaphragm seems to occur where the markings are most dense; that is, where the lines run down to about the middle of the diaphragm. Out to that point there is some limitation of the inner portion, while the outer

half, in the first stage, at least seems to work about as well as it should but with flattening or concavity often during forced inspiration. Sometimes this is one of the first appearances noticed by the fluoroscope. Later, when the fibrosis forms throughout the lungs, in the third stage of diffuse fibrosis the entire lung seems to be inelastic and does not yield to the movements of the diaphragm.

There seems to be some disagreement in regard to the distribution of the mottling of the second stage. We have found almost invariably that the changes in this stage begin to appear on the right side first and the mottling is distributed around the hilum. After very definite mottling is apparent on the right side it seems to begin to make its appearance on the left side. Later it is distributed to the base and upward toward the apex. The fibrosis may, however, be distributed throughout both lungs and is more marked in the subapical regions and less marked in the bases. This is accounted for, to a certain extent, by its being accompanied by emphysema which is almost always present in these cases. Fibrosis in the subapical regions is sometimes so dense that it seems almost like the consolidation of a tuberculous process.

Dr. Henry Field Smyth: In these examinations, in which I was associated with Dr. Landis and Dr. T. Grier Miller, we used the Palmer dust apparatus. The apparatus allows us to not only determine the total amount of dust by weight in the air, usually calculated by us in 100 cubic feet, but also to determine the percentage of organic and inorganic dust present and to make the count of the dust particles per cubic foot. We divided these dust particles into three or four different groups, using a slightly different range than Palmer's. The best conditions we found were out of doors in the country and in a country residence. Samples were taken fifteen miles out of the city, in the house and on the porch, back from the oiled street. Out of doors we found 19,000 dust particles and in the house 24,000 per cubic foot. In the city we found from 123,000 to 150,000 particles per cubic foot. The total solids by weight were very small; 2.2 mg. out of doors. In the city laboratories we secured 4.5 mg. in one test and 24 mg. in another. In the country air tests the dust was not separated into organic and inorganic groups, but the air in the city laboratories showed a percentage of about 34 or 35 inorganic matter. Tests were made in different industries for inorganic dust, 28 altogether and 37 tests for organic dust. In the cement factories there was an average of almost 7,000,000 particles per cubic foot, the highest record in the cement industries was over 15,000,000 particles. We found in some of the groups that the dust particles were very minute. Very few particles could we class in our largest size of 40 microns in transverse diameter. In almost all

instances from 50 to 70 per cent. were in the minute size of the dust. The difference in the air of country, city and the industries is very clearly shown. The country air will show about 50 per cent. in the small sized particles, while out of doors in the city and in city laboratories the percentage is over 70. We found that in very few instances was the weight of dust retained appreciable, although in some cases it was very distinctly so. A man working in the dustiest room we saw would in less than five years accumulate one pound of dust. Dr. Pancoast remarked that the metal workers showed very marked change in the lungs, and here we found that the percentage of inorganic matter was the highest of any.

OCTOBER 17

The Scope and Aims of the New Section on Industrial Medicine and Public Health

BY J. M. ANDERS, M.D., LL.D.

The honor of being chosen chairman of the new Section on Industrial Medicine and Public Health of the College of Physicians was coupled with the request that I read a brief inaugural paper on its scope and aims. In the circumstances, therefore, I need scarcely apologize for any shortcomings in connection with the task assigned to me. At the outset, permit me to express the opinion, based upon deep conviction, that the new section is fraught with great possibilities for good if the members of the College will, as I hope and believe, manifest that degree of interest in its future activities requisite to the attainment of its main purposes.

There are many problems which call for solution in the field of industrial medicine and surgery, and we should not attempt to ease our own shoulders in the present at the expense of those who will come after. The subject in its many aspects has only in the recent past been made the basis of extensive scientific inquiry in this country, chiefly by State and municipal authorities through bureaus and commissions.

Industrial health-hazards are beginning to be appreciated, but the precise effect of working under unnatural environments and in the widely various occupations that presumably endanger health are topics that remain for the most part but imperfectly understood. While recent medical literature abounds in contributions to these subjects their more modern and scientific aspects as well as some of their practical bearings have failed to attract sufficient attention in America at least. The utility of and necessity for undertaking a thorough investigation into the effect of occupation or environment upon the health of employees, not only with reference to dust, injurious chemicals and gases, but also with respect to the economic and hygienic conditions associated therewith, are undoubted.

The subject of industrial medicine and surgery is one of professional responsibility, in great part at least, hence it is altogether fitting that the College of Physicians should have created a new section having for its principal object the tilling of this field. A second closely allied domain is that of Public Health, which has been appropriately linked with industrial medicine in the title of the new section, since this will not only concern itself with the health and safety of a vast army of employees but its contemplated scope includes the consideration of subjects in the interest of the health of the general public as well as the advancement of hygiene and sanitation.

The list of communicable diseases among persons exposed through method and environment while employed is a formidable one; it practically embraces all the leading infective diseases. The relationship existing between each of these and industrial pursuits are subjects which this new section will, I trust, earnestly seek to advance. Again, there are not a few well-recognized specific industrial diseases, each of which is caused by a particular poison to which the worker is exposed. It has been well said, "As health-hazards no poisons need be dispensed with, but what is necessary is that in their use as much attention should be given to their effects upon health, both acute and chronic, as to the methods and purposes for which they are used."[1]

On the medical profession rests the serious responsibility of determining what constitutes an industrial disease. The problem is a complex one, since there are multiple contributing factors other than environment, operative in the majority of the cases, whose precise effects are difficult of estimation. The great importance of proceeding to a skeletal or thorough scientific study of the whole question is also shown by Stengel,[2] who pertinently remarks, "It would be unjust to assess on the industries of the commonwealth all or most of the responsibility for diseases, as it is and has been unjust that the worker should receive no redress or compensation for diseases manifestly the results of his work."

A whole series of problems will naturally arise and demand solution as the result of further research studies, particularly along the lines of causation and prevention. A number of creditable investigations into special subjects, however, have been carried out in recent years in the United States, notably those of Alice Hamilton, Emery R. Hayhurst, Miller and others. Two States of the Union have acknowledged their obligation to the public interests in reference to industrial hygiene by appointing commissions to investigate and report on occupational diseases, namely, Ohio and Illinois.

In this connection the new forms of poisoning, which have been met with and will continue to arise during the period of the war among the employees of munition manufacturers and in the armies in the field, will call for thorough scientific study.

I would specially urge the surgical Fellows of the College to take a proper interest in those phases of the general subject which they alone can discuss and study with profit to the medical profession and the public alike. Surgeons are called upon not only to deal with the injured themselves and those disabled by previous accidents, but should devote adequate time and attention to the broader inquiry, "How can the workmen best be made to realize their dangers and how taught to avoid them?" The question of protective devices according to the nature of the industry is one in which the surgeon should also be interested as well

as the subject of the relation of surgical services in industrial establishments to compensation laws.

Here it may be pointed out that there is urgent need of change in our compensation laws in Pennsylvania and elsewhere, as shown by Estes,[3] Codman and others, more particularly with reference to the period of direct compensation of physicians and the maximum fee for treatment; and the medical profession as well as this newly organized section of the College should be no less interested in the matter of securing the adoption of effective laws to protect the interests of the vast horde of workmen concerned.

The question which has been ably considered by Hoffmann,[4] of the effect of workmen's compensation legislation upon the frequency of occurence of fatal and serious accidents, as well as upon the incidence of industrial diseases, are subjects that call for further investigation and discussion at the hands of physicians and surgeons and should be seriously taken up by this section in the near future.

In conference with lawyers, sanitarians and legislators medical men should concern themselves with the legal rights of both employer and employee, since both can rightfully demand certain standards for their mutual protection. For example, the former may justly require proper housing conditions for their workmen while the latter are entitled to medical and sanitary supervision of their working quarters.

In industrial occupations that endanger health a physical examination of the new employees so that a proper selection or adaptation of workers can be made is a matter of much importance and one that should be espoused by the medical profession—by us. Other means intended to obviate infection and accidents, *e. g.*, cards of instruction, should be posted and their infractions severely punished. Preventive and corrective measures will, I trust, engage the interest of and discussion by the members of the new section of the College.

Many pressing problems of industrial hygiene have scarcely been touched by the sanitarians of this country. We should, as rapidly as possible, develop specialists in this new and important

domain. It is hoped that the prominent experts in hygiene and sanitation of this city will become active spirits in the deliberations of this section.

Dr. John F. Anderson[5] has well said, "Surely the prevention of industrial diseases, the general improvement of industrial sanitation and the mitigation of hazards to health inherent to industries is one of the first and most important tasks for the present generation." Our sanitarians should help the progressive manufacturer to accomplish this end, should furnish him the needed specific information with as little delay as possible.

The social worker also finds a definite and important place in this extensive field. Like the trained nurse, she is a handmaid of distinct value to the industrial physician, who should constantly avail himself of her services, and should also understand the nature and scope of her legitimate functions.

In concluding, I am well satisfied that medical schools will soon come to realize the vital need of offering, as Rush College has already done, a comprehensive course in industrial medicine. Moreover, it is a subject that should form a large part of the supplementary education of the average physician, hence our graduate schools would do well to occupy themselves seriously with the teaching of this fresh and vitally important field of professional endeavor.

Lastly, permit me to express the hope that we shall proceed with the work and activities, as herein outlined, of the section which we inaugurate tonight, in unity of purpose and the common desire for the best interests of industrial workmen and the general public alike.

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Science and Shekels: a Sociologic Excursus

BY CHARLES MC INTIRE, M.D.

(ABSTRACT)

Dr. McIntire quotes Bruce Barton to the effect that in the course of time the practical men of the world finally come to the point of view of the world's dreamers. Of the elder Agassiz it was said that when he reached in his investigations results which might be of economic importance he abandoned further research in that particular direction. This point of view is also made manifest now in the educational world by a quest for vocational studies with a disregard of what our fathers called "cultural" studies. So in medicine, more attention to shekels is evident than heretofore when the boast of the profession was that its efforts were for the benefits of mankind and were not tinctured with commercialism. It must be admitted, however, that notwithstanding this high altruistic standard there were members of the profession having a greater greed for pelf than the horse leech's two daughters. A result of the altruistic position of the physician has been the belittling of the value of medical services. Various social groups expect the physician to give his services gratuitously. Corporations, both civic and industrial, offer ridiculously low fees. As a result of this condition medical journals have exhorted readers to adopt better business methods. The trend of civilization toward the expression of values only in dollars and cents has thus permeated the medical profession to some degree. The most superficial survey of the affairs of men reveals changed conditions in the social relations of mankind, and the doctor must either adapt himself or be a constant menace by his rigid conservatism. Should we not ascertain the possible results of these changes and their future effect upon the medical profession? What is the proper course to be taken by the doctor of medicine of high ideals in the near future?

Three important forces are now at work:

1. The expanding extent of medical science.

2. The development of preventive medicine which, growing beyond public hygiene and State medicine, is becoming a duty for the individual.

3. The changes brought about by those striving for improved social conditions of the wage-earner resulting in compensation acts, health insurance, old-age pensions and the like.

1. The expanding extent of medical science is shown by a comparison of former medical curricula with the present rigid entrance examination of a modern high-school course followed by one or two years in college, with four years in the medical school and a final year of pupilage as a hospital intern. In this increased time demanded for the medical student there is crowding of work and often elective studies permitted. These requirements make preparation for a medical life more expensive, necessitating larger fees, and limit the field of activity of the individual physician. In addition the development of specialism is encouraged with an increased need of consultations with those highly trained in special branches. Thus in a perfectly legitimate and logical way the expense upon the individual for the care of an invalid has greatly increased. This frequently results in a prohibition of proper care because of insufficient income of the person paying the bills.

2. The development of preventive medicine has given a growth beyond mere public hygiene and State medicine and has placed a higher duty upon the individual. The impulse toward preventive medicine arose in the English-speaking world from the registration of mortality statistics. The demonstration of the germ theory of disease led to regarding preventive medicine as a communal procedure. From this came the public recognition that mortality was increased by the communicability of several diseases previously not recognized as communicable. The formation of life-extension institutes and similar examinations in certain of the industries led men to seek and discover the beginnings of chronic troubles and to urge hygienic advice for prevention or retardation of such diseases.

More frequent examinations and greater freedom of the family physician in suggesting the advice of specialists have an important effect upon the fee relation between physician and patient. The physician should receive proper compensation and the patient should have the advantage of expert knowledge in many domains of medicine not possible to be included in the family physician's medical experience. The present system of recompensing the physician makes it evidently impossible for these two essential factors of modern civilization to be secured to both parties.

3. The changes due to the activities of those interested in social movements, such as compensation acts, health insurance, and old-age pensions, is a prominent subject before the profession today. These sociologic movements are not new but are a development from the old provident dispensary on the recent clubs and friendly societies. Their relation to the profession brings to the doctor's cognizance the unpleasant possibility of "contract practice." In the last analysis, however, there is nothing ethically objectionable in contract practice *per se*. It is the abuses permitted to develop in "contract practice," largely through the negligence of the medical profession in its effort to maintain its non-commercialism, that have caused condemnation of "contract practice." For example, if 100 men would agree to secure the medical services of a doctor as their family physician and contract with him to attend to their families at his regular rate; present his bill to the treasurer of this club and receive pay *en bloc* instead of from each individual; and the 100 men should have formed a pool, each paying his proportion of the entire amount, no objection could be raised to the arrangement. But around "contract practice" has clustered the payment of insignificant assessments to an insufficiently recompensed physician who too often renders inefficient service.

When the leaders of the movement to better the condition of industrial workers (largely an effort to increase general prosperity by an improvement of the health of the wage-earners, and as a matter of State economy by decreasing the amount to be paid for aid to the impoverished) began their propaganda they met objection to the plan by the medical profession because of its prior objection to "contract practice."

The plan will doubtless become a reality in the near future, and, when enacted, will result in the revolution of the method of recompensing the great majority of physicians. It is the part of wisdom to recognize the trend of the world's affairs so as to adapt ourselves to the changed conditions.

This casual survey reveals the fact that the socializing of the patient removes the isolation of the medical profession, making it a cog in the machine. Consequently it will show greater forethought to adapt this cog to the use of mechanism, and thus to render it most efficient, than to oppose the new relation established between doctor and patient.

Dean Vaughan, of the University of Michigan, in a recent address, published in *Science* for December 8, 1916, has expressed this proposition as follows: "Much regret has been expressed concerning what is called the passing or the elimination of the old-time family physician or general practitioner. In the slow development of scientific medicine he served his fellow-men often with the greatest devotion and self-sacrifice. . . . In the record of the slow progress of man from the marshes of ignorance and superstition to the uplands of knowledge and science he bears a conspicuous and honorable place; but in the practice of modern medicine his part is a subordinate one." Dr. Vaughan continues that in any community where several physicians are singly doing a general practice, coöperation with specialists results in individual efficiency among these physicians and gives better service to their clients. He avers that with the establishment of a properly equipped hospital a group of village physicians may give their patients the same scientific and effective treatment that the latter could secure in larger medical centers. He is not at all in sympathy with the contention that rural populations in this country demand cheaply educated physicians, but thinks that few are in need of medical aid who may not soon obtain the services of a good physician or be transported to a hospital. A long ride by a country physician to give a single visit to a case of pneumonia, so far away that the one visit is all that could be obtained, is seldom the present situation even in rural communities accord-

ing to Dr. Vaughan. Electric cars and automobiles will nearly always be available to bring the medical or surgical patient to a well-equipped hospital, at which several physicians may daily consult as to treatment and trained nurses be in attendance.

Dr. Cabot has recently shown that but two classes of people can secure the most efficient treatment furnished by modern medical science. They are the very wealthy who can afford to pay for consultants and secure the necessary appliances for treatment and the utterly destitute, who are treated as charity patients in hospital wards. The individuals with incomes between these extremes suffer either from incomplete care or must be more or less impoverished by charges. Though all of those present will not accept this statement it has an essential accuracy for the very near future if not for the present time.

It concerns the members of this Section and the profession at large to determine how the conditions discussed by Dr. Vaughan and Dr. Cabot are affecting the medical profession. An all-round physician may be able to minister properly to his patients in a fair proportion of their ills, because it is the tendency of many maladies to recover and others do not require peculiar skill. There is a remainder in which the problems which arise are beyond his ability to solve.

How this question is met depends on the part of the physician to a greater degree upon his integrity than upon his medical ability. Fearful that if he admits his inability to treat properly one condition his patients will lose faith in his ability to treat other conditions, he is apt to do what he can and avoid suggestion of consultation with trained specialists. This apprehension of losing prestige in practice saves money to the patient and weakens the moral fiber of the physician. This tendency encourages empirical work, based upon slight analysis following imperfect investigation; and in the end-results in the pursuit of the practice in medicine for the fees to be received. Shekels have replaced science.

Other physicians, not willing to assume the entire responsibility, seek to divide the shekels with the consultant. These consultations may be with a brother all-round physician. More likely they

consist in reference of the patient to a specialist. The doctor knowing the financial standing of the patient and wishing to retain his good-will strives to have the specialist moderate his fee. The result of a continuance of this procedure is that each patient is sized up from the financial stand-point, resulting in the last analysis in practising medicine, not for service to humanity, but in an endeavor to get as much money as possible out of the individual patient.

Another type of all-round physician seeks the advice of a consultant through the agency of a hospital or a dispensary, referring patients of moderate means to these institutions for free consultation. This leads to a weakening of the moral fiber of the doctor and to teaching the patient to get something for nothing.

If the consideration of the matter in hand has brought true conclusions it will be necessary for us physicians either to abandon its boast of altruism or seek a new method of computing compensation. An attempt to work out a method for the intermediate class of patients is the proposed enactment to provide for health insurance. In this plan the coöperation of the many provides proper care for the comparatively few who are ill. It is justly asserted that this method diminishes the amount paid for the individual visit, which at present is the unit of comparison. It is also asserted that the payment by everyone of a smaller fee results in more income to the individual physician than charging a larger fee, the most part of which remains uncollectable.

The health-insurance scheme is primarily an insurance; therefore the first necessity is the efficient administration of the insured's money; this requires selection of the most skilled medical attendants. This will not be done if the selection is left to the patient and may therefore eventually eliminate the so-called panel system. There will soon be also, for the sake of efficient administration of funds, recognition of the necessity of submitting divers ailments to different physicians, with the corollary of employing two or more physicians in the treatment of one case. Ultimately there may arise the need for the employment of a medical staff for each unit of the insured and the paying members of the medical staff a fixed salary. If this method be economically sound for compul-

sory insurance among persons in mechanical pursuits it affords a clue for the economic adjustment of the relation between patient and physician in other classes of patients. A group of congenital physicians, specializing in different branches, could join forces and offer to assume the medical care of individuals or a family for a certain annual sum. Such contracts with families ought to be legal documents framed carefully and according to provisions adopted by the health-insurance authorities, specifying how much service is to be rendered in the execution of the contract. Different groups might have different scales of prices, depending upon the incomes of their clients. Persons of wealth would still be able to follow the old-fashioned way of fees for services rendered; but the doctors and groups would receive a fixed salary from the patients employing the group or from the hospital which selected them for the purpose of caring for the impoverished class.

Dr. McIntire styles himself too much of an individualist to take kindly to some of the socialistic tendencies of the present time. He fears that much of modern altruistic effort is an attempt to regulate by legislation that which should be accomplished by the development of character. There is a relationship between the family physician and his patient—a relationship of sentiment to be sure—that is not provided for in the scheme discussed. He says that his paper is simply an endeavor to read the signs of the times and to formulate what they portend, so that the ancient prestige of an altruistic profession may be conserved in the changing of social order and science and shekels kept in their proper relative position.

DISCUSSION

Dr. Edwin S. Cooke: When a medical man speaks of science he refers to that of medicine, in his efforts to advance which science I think many pay no attention whatsoever to the science of shekels. When I read the title of this paper, "Science and Shekels," the thought came to me, Why not the science of medicine and shekels combined with the science of shekels.

Dr. Roberts in reading this paper said that ours is an altruistic profession and that the gentleman who wrote the paper wishes it always to

remain so. The profession of medicine has always been an altruistic profession, and physicians in general strive to support its ancient traditions; yet there has been something done that has made the medical man a mere cog in the economic machine; something that has limited the sublime idealism of many altruistic gentlemen or lady physicians and made of him or her a part of a great machine that is sordid and commercial. Despite all highfaluting phrases and all the fine ideas of altruism which they possess, many are, to some extent, obliged to depart from the ideal and become commercial. However, altruism always has existed in the practice of medicine and probably always will; without it we would not have been physicians; we would never have studied medicine, and those who have made us anything but ultra-altruistic, those who have placed a limit on our very finest ideals and influences are the people who are gathering in shekels which rightfully belong to the self-sacrificing physicians.

The individual method of fixing rates of fees has been tried from time immemorial and will always be followed by a large class of physicians, for no matter what they charge or where they practice or whatever methods, a limited number of physicians are going to be chosen for personal qualities and not for any other reason. We all know that some physicians of great importance in the eyes of the public are not important to other members of the profession. They are chosen for individualistic reasons, for their personality and for their peculiar magnetism. Such doctors are laws unto themselves.

The only way medical men in general can improve incomes; the only way we can do anything to combat the socializing tendency of the present day, is to consolidate and set our own prices; to fix our own fee standards and live up to them. When the legislature meets to enact legislation affecting physicians or when the United States Government undertakes to gather together a number of physicians and put them into the military service, doctors and their science are regarded purely from the standpoint of commercialism. Employers will engage so many laborers to unload so much timber or so many physicians to look after the health of their employees. How will they rate them? As low as they can get them to give their services. If these services are given for the minimum fee, that will be paid; if the labor unions and the physicians stand for something better, the higher amount will be paid. The medical profession is not an enormous profession.

There are other vocations in which there is much more competition and yet whose members combine for excessive prices. The members of the medical profession, having in their hands the power of life and death; to whom everybody comes at the end as in the beginning of life; having

the secrets of the confessional and the alleviation of the mental and physical sufferings of mankind; who take the burdens and sorrows of all sorts of people; who do everything in their power to make easy the pathway of the sick, these get the smallest possible fees that can be given to them, and sometimes not even that. The only method by which the medical profession can attain any better financial condition, the only method to get shekels for our science is to develop the science of shekels. It is well enough to say that we do not want to commercialize the profession; it is already commercialized, on the scale downward. Let us commercialize it on the upward scale. I heard doctors speak thus of one of the small organizations known as beneficial societies and which are responsible for commercializing the profession. He is called to see a patient because he is the physician for the society. He makes two or three visits which cost the patient almost nothing. If the patient does not improve very rapidly a physician making a higher charge is called. If further improvement is not soon made a higher-priced physician is called and a good fee is paid. This gentleman spoke the truth about cheap contract lodge practice. You and I have had to deal with patients who apparently could illy afford to pay the minimum fee, but who when a consultant was asked for would name one to whom they would pay $25 and thank him for the privilege. If anything helped the patient the help was attributed to the high-priced man of course.

We as physicians are underestimating ourselves. We are placing ourselves in the position of being regarded as cogs in the commercial world, and inferior cogs at that. The financial end makes us inferior; in every other way we are very superior cogs. Physicians have been called from every rank of the profession to go into the army. The physician has been commercialized by the Workman's Compensation Law: he has been placed at the disposal of the United States Government by the creation of the Medical Reserve Corps. With all true patriotism we are glad to have it so, but many suffer great financial loss in accepting commissions. If the medical profession would rate itself so high that it might be regarded as it was originally, as something god-like, its members having power more than merely to dispense medicine; as comprising the descendants of Æsculapius and Hippocrates; if it could educate and elevate the public's mind to regard physicians at their true value, we might get the shekels, have better incomes and more credit for our science.

The higher the fee and the more dignity displayed in asking for it the greater the confidence reposed in the individual professional man.

In the last few months I have met several gentlemen who have been placed in unpleasant positions by reason of charging small fees, "an

agent of hospitals" is how one described himself, for he said he would make a call on a patient, and if the patient was only moderately sick a small fee would be paid. If the patient was decidedly sick he was asked to have a consultant who received a better fee, and if the patient were likely to be ill for some time a request would be made that he be taken to a hospital. So the attendant merely was a cheap man and an agent for the hospital.

The secret of success is coöperation. Men and women will not back each other up in every proposition that tends to the advantage of the profession. You will find members of the profession who will speak absolutely badly of others. Others who will speak not absolutely badly, but merely to cast reflection upon some other. These keep themselves and those of whom they speak in the lower ranks. We must coöperate voluntarily or the Legislature will make us coöperate.

We all know the disadvantages of cheap practice, that the doctor who is cheap cannot give the consideration to the individual patient that he should; that he is after the money and that he gets it at the peril of the patient. If fees were properly regulated by professional ethics such conditions would not exist. Pride would require that the service rebound to the credit of the physician.

The dollar now is worth 40 cents compared with its value of a few years ago. The medical man who receives $3000 from his practice today is not as well off as the man with a $1000 practice a few years ago. The medical service rendered, however, is better now than then. The medical schools and scientific teaching are better, the colleges have all been improved by those who insist upon rigid examination and hospital experience and we have very few unqualified physicians. The standard medical education has been increased enormously and the expense of medical education has been increased out of all proportion. Somebody should pay the interest. The fee is $1 now as it was many years ago. We should all stand by each other in helping the profession; and if it is to be commercialized let us have it commercialized along lines that will increase the fees, and if possible to give better service to the public.

Dr. William S. Higbee: Dr. McIntire has given us many valuable suggestions, which will be most profitable to those engaged in industrial work. I agree with Dr. Cooke in his discussion of this paper, as my experience has been similar to his. We should also take into consideration these points and endeavor to improve the condition.

The Relation of Cripples to the Public

BY GWILYM G. DAVIS, M.D.

This section of the College has to deal with questions involving the relation of our industries to the public in medical matters. Of these questions few are of more importance than that of the cripples arising among our industrial workers.

It is needless to point out that there are many thousands injured annually in our various industries.

Many of the injuries received are slight and recovery is both rapid and complete. Some of them are so severe as soon to cause death. In either case the patient does not become a serious charge on the community. Between these two extremes, however, there exists a tremendous number of injured and crippled workers who for shorter or longer periods are disabled and thereby prevented from working. These then cease to be producers and become consumers only. Instead of adding to the wealth of the community they become a drain on its resources. When a community is wealthy and living, so to speak, cheaply a certain number of cripples can be tolerated without great discomfort, and they are apt to be ignored and allowed to idle their way along without any special help or interference: This has been the case in this country. Times, however, are changing. The land is becoming more settled and our population more dense and the struggle for existence more acute. This has compelled the public to pay some attention to the conservation of its resources, and now efforts are being made to restore to our industrial cripples, as nearly as possible, their former efficiency and thus remove them from the dependent class.

These efforts are being made in three directions, all more or less new and in process of development.

1. The State has inaugurated an insurance or compensation plan which aims at aiding or supporting the cripple during the period of his disability.

2. The social service workers render a more personal help to the cripple and his family, especially in their home relations.

3. The medical profession through its own members and allied or associated workers endeavors directly to lessen and remove the disability or to counteract its evil effects by changing the character of the occupation of the patient into some new and more suitable field.

In spite, however, of the efforts of these three classes of workers, the cripple question is still far from being solved. The public itself is to a great extent ignorant and sometimes indifferent as to both what should be done for the cripple and how it should be done. This is evidently so in the case of the beggars which we see in our streets; glaring examples of the incompetence and indifference of both our government and our people.

I knew of a healthy beggar with only one leg formerly conspicuous on one of our public thoroughfares. During the blustry, wintry months he hibernated in the genial and salubrious resort of Blockley (Almshouse). When the weather permitted he squatted on Chestnut Street and gathered much money. Two charitably disposed ladies sought my aid in providing him with an artificial limb. Sixty-five dollars was needed. In an interview with him he readily offered to contribute thirteen dollars himself, one of the charitable ladies contributed twenty-five and the other twenty-seven, and I obtained the promise of help from our instrument maker and other charitable sources. He was then requested to go and get measured for his artificial leg. The result was that nothing further was heard from him. He had no desire to be placed in such a condition that would require him to work.

Is it not evident that this case was not handled properly? Are not such cases occurring today? Although they are not so abundant as formerly the public still tolerates them. The time has come for us to wake up! All too soon we are going to have a deluge of more or less helpless cripples: we are in the midst of a terrible war. The general government is realizing the tremendous task before it and is organizing to meet it.

Fortunately it finds a nucleus already established—orthopedic

surgery in its broadest and truest sense is at last being recognized. We are now no longer content to simply treat these cases as ordinary injuries to be given general surgical aid until their wounds are healed. It is now becoming recognized that they should receive treatment also from the time they recover sufficiently to leave the care of the general surgeon until they are so completely restored as to be able to resume their work. For this to be accomplished requires entirely different treatment, under different conditions and by an entirely different class of surgeons. This is true orthopedic work; the government calls it reconstructive work. The State recognized its necessity when it passed the Workmen's Compensation Act. The people at times have appreciated it as seen in some of our institutions like the Widener Industrial School, where surgery, education and training unite to make the cripple self-sustaining. The medical profession is beginning to support it as shown in the wonderful strides made in the development of this reconstructive branch of surgery.

While much has been done more remains to be done, both the profession and the public need to be aroused to the necessity of taking better care of their industrial cripples. A surgeon is too apt to think that his duty is done when he sees a patient's wounds healed, but not so, it is either his or someone else's duty to see that the resultant disability is removed, and that may require months of subsequent treatment by massage, passive movements, apparatus, operations and physical, mental and industrial training. To carry this out requires the service of those specially fitted and trained for the work. The general surgeon has not the temperament, the equipment, the facilities nor the knowledge to fit him for this task, hence these cases of necessity fall to the care of the orthopedist.

The public has not made proper provision for the treatment of its crippled members. Its public institutions are largely closed to them and of necessity they drift around untreated. The demand for beds in our general hospitals is so large for acute and operative cases that the chronic orthopedic cases are but rarely admitted. Most of these cripples require a comparatively long

stay in the hospital, therefore not many hospitals will admit them. They are discriminated against and only a few can obtain treatment in the limited number of orthopedic beds available. The number of orthopedic cases in those injured in war is said to be 40 or more per cent. The proportion of these chronic orthopedic cases in civil surgical practice is probably just as large, yet there is not a hospital in our community that devotes as many beds to chronic as to acute cases. Occasionally there may be a ward for convalescents or other undesirables, and in them we find these cases are apt to be ignored and left largely to the care of subordinates. This is all wrong: they should be under the care of someone who is interested in their welfare and qualified to treat them, and that is the orthopedic surgeon. It is the duty of our community to provide additional facilities for these cases, and it is a disgrace that proper provisions are not made for their treatment. Since the Workmen's Compensation Law has been instituted a demand has arisen for accommodations for cripples who can pay a moderate amount. At present there is no proper place for them. The private rooms are too expensive for them and they are perforce compelled to enter the wards if they get in at all. Here they may be compelled to pay for everything except treatment, but why everyone should get paid except the doctor is difficult to understand. The solution of this latter problem may perhaps be found in the establishment of semipay wards and hospitals in which something is paid for treatment as well as board.

This great war will not have occurred in vain if it arouses our people to the necessity of the proper care of their cripples.

It may seem strange, but it is true, that nearly all of our cripples can be made to a considerable extent or entirely self-supporting if they are only properly cared for and encouraged.

DISCUSSION

Dr. A. Bruce Gill: In these few remarks I desire to present a broad view of the subject of the relation of the cripple to the public and of the public to the cripple, and to point out the necessity of our formulating

some comprehensive plan along which we should work toward the attainment of the ideal end. If this ideal end seems too far distant or too lofty, let us not forget that the world is moving rapidly in these latter times and that the dream of today may have become past history by the day after tomorrow.

The cripple is a defective. He lies outside the wall of the normal—I say wall purposely. There are other defectives, the mental and the moral, who also lie outside the pale. For ages what has been the attitude of society and the State, *i. e.*, of the normals within the wall, toward all defectives who live without? They have shut their eyes that they might not see: for the abnormal is a deformity, an ugliness, that shocks the sense of the beautiful and disturbs one's mental and emotional placidity. This attitude persists today in many people who shun the sight of cripples because it "makes them feel badly." Organized society has recognized defectives only as they have been a menace to society. They have been made paupers, beggars and criminals and have been segregated in almshouses, in asylums and in prisons. They have been starved, punished and killed. Like the lepers of old they have been driven without the city, beyond the life and the walk of the clean; and it has been left almost alone to occasional private charity to go forth to seek the defectives, whether physical or mental or moral, and to take them by the hand as a brother or sister, to cleanse them, to cure their deformity and to lead them back into the city beautiful.

How long has it been since the criminal has been treated otherwise than a vicious man who must be punished or killed? How long has it been, even, since our prisons and almshouses and asylums have been made cheerful and comfortable and home-like places to live rather than dull, gloomy dens almost comparable to the tombs in which the lepers dwelt? How long have these unfortunates been decently clothed and fed? Stripes and hideous uniforms have not yet disappeared. What serious effort has organized society ever made to cure defectives, so far as possible, to train them to occupy a useful place in the world and to admit them to our daily walk in life, whether of business or of pleasure? Is it easy for a man who has spent a term in a penal institution to find honest employment after his discharge? And what opportunity has the cripple to learn to do a man's work and to find admission to the usual occupations?

But a great principle is slowly working to alter the old relation of the normal to the abnormal, to open our eyes, to remove the disgust and intolerance toward the weak, the deformed and the unfortunate. The truth is working in a hundred different ways, which we see but dimly or not at all. Prison reforms of all sorts; the various investigations into the causes and conditions of the social evil and other vices; the establish-

ment of homes and schools for the care and training of cripples and other physical defectives; the founding of societies to find honest employment for various kinds of unfortunates—all these and many other recent activities are but manifestations of the truth that it is the serious duty of society to recognize that the abnormal does exist, that it is a deadly menace to the welfare of mankind and that it is to be treated not by expulsions or by punishments or by spasmodic charity, but by comprehensive systematic training and development, that the abnormal may grow more like the normal and that the defective may become an efficient member of society.

We have long recognized the advantage of training and developing the normal individual to the utmost. Schools, public and private, colleges, institutions of a hundred kinds have for centuries been training the youth of the world, and our present wonderful era of knowledge, science, prosperity and comfort is the result of this prolonged effort. Has not the time come for the systematic care and development of that large body of defectives who are a menace as well as loss to society. It is the idle, the poverty-stricken, the weak-minded, the crippled, who constitute the vast underworld that has always been a deadly menace to civilized society, and that is ever ready, at the slightest opportunity, to swarm from cellars, sewers and slums, with hand raised against every man. The normal has been tended and reared and has grown into the great tree of modern civilization, but there are countless creeping, crawling things that are gnawing at its roots and digging into its sap-wood. It has been said that the marvelous civilization of the ancient Greeks was only the illuminated top of a vast pyramid whose base lay in shadows. The few were highly educated and wealthy, the many were paupers and slaves. The safety of our civilization lies in the education and enlightenment of all classes of citizens.

Now arises the question as to how this shall be accomplished. We have but to open our eyes to the marked trend of the present times and our question is answered. It is a truism that the whole is composed of its parts. From this it follows that the people, as a whole, *i. e.*, organized society, whether the community, the State or the nation, should concern themselves with the welfare and the development of the individual, and that the individual or groups of individuals should be controlled for the welfare of the whole. Centralization of power, socialism—call it what you will.

We are not fighting the centralization of power that is lodged in the German Government, for Wilson and Lloyd-George probably hold in their hands much greater authority than does the German Kaiser; nor shall we soon forget the lesson we have learned of German organization

and efficiency. We cannot deny it, the great tendency of the times is toward central control of the great industries and activities of national life. But this control shall be for the benefit of the people, and the heads of power shall be answerable to the democratic whole, not to the autocratic few.

Nor shall this power be limited to the control of railroads, coal and copper mines, water supplies, forests, the bread we eat—the physical things vital to the welfare of all. It governs as well the education of our children and the health and comfort of all the people. Are we not only beginning to realize that the strength and health of our citizens vitally concern the nation. They are our greatest asset, both in times of peace and in times of war. For years far-seeing physicians have demanded that a health officer should sit in the Cabinet at Washington. Now in the time of crisis the ablest members of our profession are summoned to the nation's need. Organized society should provide for the proper care and maintainance of the poor, the sick and the crippled who cannot care for themselves. Our present methods are a great injustice to the medical profession which takes largely upon its own shoulders the care of the sick who are too poor to pay for proper attention. Our hospitals are maintained by private charity and by the public purse, but the surgeon and the physician receive no recompense for their long hours of labor there. That this principle of central control of health is making headway is shown in the growing power of officers and boards of public health, in the medical care given to children, enactment of laws for the compensation of industrial accidents, in the establishment of State institutions for the care and education of cripples and in the efforts made to segregate the feeble-minded and the insane. But only the beginning has been made.

Look forward through the years and see with the mind's eye a reconstructed world. There will be no idle and no poor, for there will be no rum, and every man and every woman shall have a work in the world for which they have been trained and for which they shall receive just compensation. The things that drive men to crime shall be no more. And the weak and the feeble-minded, who constitute so large a portion of the criminal class, also shall have a work to do so far as they are able; or shall, at least, lead a happy and peaceful life, where they may no longer menace society by their actions or by the propagation of their kind.

Following this great war there will be a vast reconstruction of ruined cities and lands, of crippled men, of governments and of the lives of people. The world will never again be what it was before. The times are rushing forward incredibly fast; and in the new life the poor shall hold up his head, and the cripple shall walk and have an honorable place among men.

In conclusion, it may be said that while the cripple is physically handi-

capped, in other respects, he is, in most cases, a normal individual. Naturally he is as full of energy and ambition as are other people and desires to occupy a useful and independent position in the world. But he needs a chance; and the public owes it to him and to itself to give him this chance, to afford him at least equal opportunity with others to secure an education and to fit himself for work and to secure employment for which he is suited.

This, I take it, is the proper relation of the cripple to the public and of the public to the cripple. When this war shall pour into our midst thousands of crippled men, then the issue shall be forced upon us, and we shall be obliged to enter upon some comprehensive system for their care.

Dr. Frank B. Block: I wish to take issue with the remarks of the last speaker upon the question of cripples in the industrial world. I would also like to call attention to the role of the industrial surgeon in looking after the cripple. I should say that when he is through with the surgical work of the case that it is up to him to see that the cripple is not turned down simply because he is a cripple. I do not believe he is in as many instances as has been stated. I am connected with one or two very large corporations and in one of them everyone must pass a physical examination before he is employed. I have often wondered at the number of crippled people working there. They are not rejected unless they are absolutely incapable of doing the work. The fact that a man may be a cripple has nothing to do with it. A few weeks ago a man came into my office for examination for employment in this corporation who was so crippled that he could not stand upright. He had some sort of dystrophy affecting the muscles of his back. He moved himself along by having a hand on each foot and pushing himself in this way. He gets around town on a tricycle and goes to his work of telegraph operator, which work he has been doing for years. I know also of many hunchbacks and other cripples working in the same place and they have good attention.

Another point is that of what shall be done with the employee crippled as the result of his occupation? Should he be rejected by the firm in whose establishment he received the injury? In the past the tendency has been to reject men for such injury, to simply cast them aside. The Compensation Law has changed that attitude somewhat, but I believe that most of the large corporations today as the result of law and welfare work are doing the best they can for those crippled as a result of their occupation. In another establishment in town a man whom Dr. Roberts knows, having treated him, and who was severely hurt by falling from a scaffold, is now back at his work as carpenter. The work was so regulated that he would not have to do the kind he could not do with ease. In another instance

a man with a compound fracture of the leg, with a resulting deformity who ordinarily would have been rejected, was put to work sorting bolts and nuts. The thing for the industrial surgeon to do is to see that the man is taken back and given work he can do and for which he receives adequate remuneration, so that he is not a charge upon the community. I think that a Section of this type of the College of Physicians is the ideal place for discussion of problems of this kind. I simply wanted to take issue with the last speaker, who said that the large corporations are not looking out for the cripples.

Dr. Walter G. Elmer: Dr. Davis has brought out a number of interesting points. These bear direct relation to an editorial, recently read, in which it was stated that the number of cripples the result of industries in the United States equalled those of the European War. We are unable to accept this statement, but probably we shall have a large increase of cripples during the coming months. Our industries will have to specialize in the employment of their workers. Certain positions can be set aside which injured men coming back from Europe will be perfectly able to fill, and it will be looked upon as rather an ungracious act for a healthy and normal man to take such a position. Probably by some such plan many of these crippled young men will not be cast adrift to suffer the depressing mental conditions of enforced idleness. While they may be cared for in their own homes or in institutions, it is far better to have them engaged in useful occupations, for then the whole mental attitude of the cripple changes. He becomes hopeful and realizes that he is a part of the great industrial machine. There are other interesting points which might be mentioned, but the hour is late.

LIST OF PRIZES AND LECTURES

THE WILLIAM F. JENKS MEMORIAL PRIZE

(Triennial)

1889	John Strahan, M.D.	Belfast (Ireland).
1895	Abram Brothers, M.D.	New York.

NOTE—June 12, 1900, the William F. Jenks Memorial Prize Fund was transferred to the Library as the "William F. Jenks Memorial Library Fund."

ALVARENGA PRIZE OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA

(Annual)

1890	R. W. Philip, M.D.	Edinburgh (Scotland).
1891	L. Duncan Bulkley, M.D.	New York.
1892	R. H. L. Bibb, M.D.	Saltillo.
1894	G. E. de Schweinitz, M.D.	Philadelphia.
1895	Guy Hinsdale, M.D.	Philadelphia.
1897	Joseph Collins, M.D.	New York.
1898	S. A. Knopf, M.D.	New York.
1899	Robert Randolph, M.D.	Baltimore.
1900	David de Beck, M.D.	Cincinnati.
1901	George W. Crile, M.D.	Cleveland.
1903	William S. Carter, M.D.	Galveston.
1905	D. Chalmers Watson, M.D.	Edinburgh (Scotland).
1907	William Louis Chapman, M.D.	Providence.
1908	William T. Shoemaker, M.D.	Philadelphia.
1910	M. Katzenstein, M.D.	Berlin (Germany).
1911	Francis D. Patterson, M.D.	Philadelphia.
1914	H. B. Sheffield, M.D.	New York.
1915	J. E. Sweet, M.D.	Philadelphia.
1917	Wilburt C. Davison, M.D.	Baltimore.

NATHAN LEWIS HATFIELD PRIZE FOR ORIGINAL RESEARCH IN MEDICINE

(Triennial)

1901	Henry F. Harris, M.D.	Atlanta.
1909	Martin Henry Fischer, M.D.	Oakland.
1917	A. B. Macallum, M.D., F.R.S.	Toronto.

NOTE.—November 29, 1913, by Supplemental Deed of Trust, the title of this Fund was changed to "Nathan Lewis Hatfield Prize and Lectureship."

WEIR MITCHELL LECTURES

Jan. 17, 1911	Arthur R. Cushny, M.D.	London.
Mar. 30, 1911	Edmund B. Wilson, Ph.D., LL.D.	New York.
May 16, 1911	Svante Arrhenius	Stockholm.
Nov. 3, 1911	William T. Porter, M.D.	Boston.
Mar. 29, 1912	William H. Howell, M.D.	Baltimore.
Oct. 21, 1912	G. H. F. Nuttall, F.R.S., M.D.	Cambridge (England).
April 4, 1913	H. P. Armsby, Ph.D., LL.D.	Pennsylvania.
Feb. 25, 1914	Harvey Cushing, M.D.	Boston.

PUBLIC LECTURES

Feb. 16, 1910	S. Weir Mitchell, M.D.	Philadelphia.
Nov. 17, 1910	Simon Flexner, M.D.	New York.
Dec. 15, 1910	William H. Welch, M.D.	Baltimore.
April 18, 1911	James G. Mumford, M.D.	Clifton Springs, N. Y.
Nov. 20, 1911	Talcott Williams, A.M., LL.D., Litt.D.	Philadelphia.
April 29, 1912	Owen Wister, A.M., LL.D.	Philadelphia.
Feb. 17, 1913	John K. Mitchell, M.D.	Philadelphia.
Feb. 15, 1916	Daniel J. McCarthy, M.D. and Walter Estell Lee, M.D.	Philadelphia.
April 15, 1916	Surgeon A. M. Fauntleroy	U. S. Navy.

MARY SCOTT NEWBOLD LECTURES

Mar. 29, 1917	A. T. McCormack, M.D.	Bowling Green, Ky.

MÜTTER LECTURES

1865	J. H. Packard, M.D.	Philadelphia.
1866	J. H. Packard, M.D.	Philadelphia.
1867	J. H. Packard, M.D.	Philadelphia.
1868	Harrison Allen, M.D.	Philadelphia.
1869	J. H. Brinton, M.D.	Philadelphia.
1872	J. da S. Solis Cohen, M.D.	Philadelphia.
1879	S. W. Gross, M.D.	Philadelphia.
1882	E. O. Shakespeare, M.D.	Philadelphia.
1885	H. F. Formad, M.D.	Philadelphia.
1888	O. H. Allis, M.D.	Philadelphia.
1890–1891	Roswell Park, M.D.	Buffalo.
1893–1894	De Forrest Willard, M.D., and Guy Hinsdale, M.D.	Philadelphia.
1896	O. H. Allis, M.D.	Philadelphia.
1899–1900	J. B. Roberts, M.D.	Philadelphia.
1901	H. W. Cushing, M.D.	Boston.
1902	L. A. La Garde, M.D.	Washington.
1903	C. N. B. Camac, M.D.	New York.
1904	G. H. Monks, M.D.	Boston.
1905	A. O. J. Kelly, M.D.	Philadelphia.
1906	W. J. Mayo, M.D.	Rochester, Minn.
1907	J. Rogers, M.D., and S. P. Beebe, M.D.	New York.
1908	G. W. Crile, M.D.	Cleveland.
1909	H. D. Fry, M.D.	Washington.
1910	T. W. Hastings, M.D.	New York.
1911	C. F. Nassau, M.D.	Philadelphia.
1912	J. C. Bloodgood, M.D.	Baltimore.
1913	R. C. Coffey, M.D.	Portland, Ore.
1914	F. H. Albee, M.D.	New York.
1915–1916	Rudolph Matas, M.D.	New Orleans, La.
1916	Nelson M. Percy, M.D.	Chicago, Ill.
1917	Chevalier Jackson, M.D.	Philadelphia.

ANNUAL REPORT OF THE LIBRARY COMMITTEE FOR 1917

MR. PRESIDENT: In accordance with the ordinances and By-Laws of the College, I herewith submit the following report of the Library Committee for the year 1917:

Total number of volumes in the Library, including the bound volumes and 16,451 unbound "Reports" and "Transactions"	119,019
Number of unbound "Theses" and "Dissertations" .	9,010
Number of unbound pamphlets	93,133

Included in the above are 3,487 volumes known as "Reserves" consisting of second copies of some of the more important periodical publications; also 2,976 volumes more or less incomplete.

The duplicates, which are not included in the above total, number 5,028 at this date.

The following table shows the number of volumes in the various divisions of the Library:

	Bound.	Incomplete and unbound.	Total.
General Library . . .	82,200	2,929	85,129
Lewis Library	13,609	44	13,653
On permanent deposit:			
S. D. Gross Library . .	3,566	3	3,569
Library of the Obstetrical Society of Philadelphia	217	0	217
			102,568

Received during the year from all sources 3,642 volumes, 7,930 pamphlets and 12,867 numbers of various periodicals.

Divided as follows:

	Volumes.	Pamphlets.	Journals.
General Library	2,776	7,909	12,867
Lewis Library	13		
S. D. Gross Library	7		
By purchase from General Account	390		
In exchange	456	21	
	3,642	7,930	12,867

Accessions (including 8 volumes of "reserves"):

General Library	2,586
Lewis Library	13
S. D. Gross Library	7
	2,606

Total increase in number of volumes for the year, 2,606.

Photographs received in response to requests sent out during the past year:

Fellows of the College, 4. Foreign, 0.
Total number of portraits listed, 8,281.

An attempt will be made to obtain the portraits, in uniform, of the Fellows of the College in the service of the Government, to form a war album.

The individual "donors" for the year ending November 1, 1917, number 478; this represents 986 distinct presentations. Each gift is duly acknowledged and properly recorded.

The following list shows the donations of twenty-five volumes or more and the number of volumes presented by the various publishing houses:

	Volumes.
Dr. Richard C. Norris	126
Dr. Samuel W. Morton	105
Dr. F. S. J. Stoddart	81
Dr. C. S. Turnbull	79
Mrs. Alexander W. Biddle	78
Dr. William W. Keen	72
Dr. Benjamin D. Parish	65
Dr. H. K. Pancoast	64
Dr. H. R. M. Landis	62
Dr. A. P. C. Ashhurst	61
Dr. James C. Wilson	46
Dr. Hobart A. Hare	43
Dr. Robert G. LeConte	34
Dr. George M. Piersol	30
Dr. William G. Spiller	27
Dr. G. E. de Schweinitz	26

From the publishing houses of:

P. Blakiston's Son & Co.	30
F. A. Davis Co.	12
Lakeside Publishing Co.	1
Lea & Febiger	14
J. B. Lippincott Co.	14
W. B. Saunders Co.	59
William Wood & Co.	9

The Library is indebted for large gifts of pamphlets and unbound periodicals to the following donors:

Dr. Herman B. Allyn
Dr. A. P. C. Ashhurst
Dr. John Aulde
Dr. Charles Baum
Messrs. P. Blakiston's Son & Co.
Dr. Charles W. Burr
Dr. Henry W. Cattell
Dr. Burton Chance
Dr. S. Solis Cohen
Dr. E. P. Davis
Dr. G. G. Davis
Dr. Henry M. Fisher
Dr. M. H. Fussell
Dr. Charles H. Frazier
Dr. Edward H. Goodman
Dr. Alfred Hand
Dr. H. A. Hare
Dr. F. P. Henry
Dr. Addinell Hewson
Dr. A. Bern Hirsh
Dr. W. W. Keen
Dr. John A. Kolmer
Dr. Henry R. M. Landis
Dr. Robert G. LeConte
Messrs. J. B. Lippincott Company
Dr. Mason McCollin
Dr. Edward Martin
Dr. William J. Merrill
Dr. Charles K. Mills
Dr. Thomas R. Neilson
Dr. George W. Norris
Dr. Richard C. Norris
Dr. C. A. O'Reilly
Dr. Francis R. Packard
Dr. Benjamin D. Parish
Dr. John B. Roberts
Dr. Paul J. Sartain
Messers. W. B. Saunders Company
Dr. G. E. de Schweinitz
Dr. Edward A. Shumway
Dr. C. F. Taylor
Dr. T. Turner Thomas
Dr. William H. Wells
Dr. H. R. Wharton
Dr. DeForrest P. Willard
Dr. James C. Wilson
Dr. W. S. Wray
Dr. William Zentmayer
Dr. M. W. Zimmerman

764 new publications were added to the Library during the past year; 37 of these works were written or edited by Fellows of the College.

14 volumes were presented by the following authors or editors:

Dr. W. A. N. Dorland
Dr. Hobart A. Hare (editor)
Dr. Edward Jackson (editor)
Dr. Joseph McFarland
Dr. W. Campbell Posey
Dr. T. H. Shastid
Dr. H. B. Wood

24 volumes were sent by the publishers at the request of the following authors or editors:

Dr. Albert P. Brubaker
Dr. Edward P. Davis
Dr. John B. Deaver
Dr. R. Max Goepp
Dr. H. A. Hare (editor)
Dr. William W. Keen
Dr. T. C. Kelly
Dr. Henry R. M. Landis (editor)
Dr. E. E. Montgomery
Dr. John H. Musser, Jr.
Dr. George A. Piersol
Dr. C. E. deM. Sajous
Dr. H. W. Stelwagon
Dr. J. Madison Taylor
Dr. H. C. Wood, Jr.
Dr. James K. Young

Summary of the "Funds."

	Volumes purchased.	Cost.
Henrietta Rush Fales Baker Fund	49	$77.08
Luther S. Bent Fund	25	27.53
William T. Carter Fund	39	63.74
Gerardus Clarkson Fund	2	2.02
Francis X. Dercum Fund	62	124.12
Louis A. Duhring Fund	13	49.86
John D. Griscom Fund	46	70.76
William F. Jenks Fund	45	129.17
Oliver A. Judson Fund	0	0
William V. and John M. Keating Fund	20	36.88
William W. Keen Fund	16	50.78
Library Endowment Fund	46	117.04
Horace Magee Memorial Fund	142	255.65
J. Ewing Mears Fund	49	85.20
Charles K. Mills Fund	5	3.99
Weir Mitchell Fund	13	59.15
John H. Musser Fund	7	5.49
Elizabeth K. Newcomet Fund	21	26.71
William F. Norris Fund	28	108.71
Charles A. Oliver Fund	6	20.48
Philadelphia Medical Society Fund	1	9.14
Lewis Rodman Fund	18	54.35
Douglas Stockton Warren Fund	59	89.15
John F. Weightman Fund	4	6.46
Caspar Wistar Fund	41	95.45
	757	$1,568.91

Special Accounts:

	Volumes purchased.	Cost.
Fund for completing files of journals	42	$93.90
Fund for rare and valuable books	176	3,248.21
New Book Fund	6	17.41
S. D. Gross Library Account	3	18.05
	227	$3,377.57

George B. Wood Fund for Library supplies, stationery, etc. Expended $324.70.

Morris Longstreth Fund. Expended on Account of Salaries, $558.53.

Catalogue Endowment Fund. Expended on Account of Salaries, $49.00.

	1917.	1916.	Decrease.
Books bound	1,205	1,253	48

	1917.	1916.	Decrease.
Number of visitors to the Library	3,864	5,910	2,046
[Fellows of the College	1,116	1,864]	748

The Library has been kept open two evenings each week and on the six minor legal holidays, for the same hours and period of time as during the past year.

	1917 (79 evenings).	1916 (77 evenings).	Decrease.
Visitors, evening	510	553	43
[Fellows of the College	132	156]	24
Visitors, legal holidays	50	74	24
[Fellows of the College	11	17]	6

The above figures are included in the total number of visitors for the year.

	1917.	1916.	Decrease.
Number of books consulted in the Library	10,764	18,808	8,044

The number of books reported as "consulted in the Library" includes only those supplied on demand. Readers have access to the bound volumes kept on the shelves in the Reading-room, and the Fellows of the College have access to the Book-stacks. There are, therefore, a great many volumes consulted of which no accurate record can be kept.

	1917.	1916.	Decrease.
Number of books taken out .	3,450	4,533	1,083
	Daily Average 1917. Volumes.	Daily Average 1916. Volumes.	Decrease.
Use of study rooms . . .	197	203	6
	Works.	Volumes.	Cards written.
Cataloguing	1,381	1,545	10,759

All the books added to the shelves during the past year and 376 of the more important pamphlets have been catalogued and shelf-listed, and all bound volumes, including periodicals, transactions and reports, have been accessioned.

In addition to the typewritten cards, 1,493 printed cards obtained from the Library of Congress have been added to the catalogue.

10,712 unbound pamphlets and reprints have been subject-headed and arranged alphabetically by subject, and by author under the subject. Since the last annual report the Library Committee determined that all miscellaneous bound volumes of pamphlets upon the shelves should be taken apart and the pamphlets subject-headed; this is now being done as rapidly as possible. The binding by subjects will not be commenced until this work is completed.

Revision of the Catalogue: Number of cards revised, typewritten, examined and alphabeted for the year ending November 1, 1917: 15,967.

The revision of the catalogue has been completed to the end of the second series of the Index Catalogue of the Library of the Surgeon-General's Office.

The current periodical publications, including "Transactions" and "Reports" that we have listed, to be received as issued, are obtained through the following sources:

	American.	Foreign.
Endowment Funds	17	295
By purchase from General Account	53	446
In exchange	87	76
Editors	118	21
Publishers	46	2
In addition, current numbers of periodicals are received, at stated intervals, through the courtesy of the editors and editorial staff of the following journals:	113	23
American Journal of the Medical Sciences		
Therapeutic Gazette	—	—
	434	863

Actual number of current periodicals received at this date: 541.

It will be seen from the above figures that we have received less than one-half of the current periodical publications listed on our cards. No German publications have been received, which accounts for 348. The decrease in French is 173, in Great Britain and Colonies 38, in Italian 30, in other countries 37, and in the United States 120. Undoubtedly a large number of the foreign journals have ceased publication; the American journals not received were included under the head of Exchange and gifts from the Editors or Publishers. Letters have been sent to all, the few replies received were practically the same in each case—high cost of paper and extra working expenses have forced them to reduce the number of exchanges and cut out all complimentary copies. In a few cases it was reported that the publication had suspended.

	American.	Foreign.	Total.
New subscriptions added during the past year:	9	34	43

The following is a list of the foreign schools of medicine with which we exchange publications:

University of	Amsterdam	University of	Königsberg
"	Basel	"	Lausanne
"	Berlin	"	Leiden
"	Bern	"	Leipzig
"	Bonn	"	Liège
"	Breslau	"	Lund
"	Erlangen	"	Marburg
"	Geneva	"	Rostock
"	Giessen	"	Strassburg
"	Göttingen	"	Upsala
"	Griefswald	"	Utrecht
"	Halle	"	Würzburg
"	Heidelberg	"	Zurich
"	Keil		

Faculty of Medicine of Bruxelles
" " Paris
" " Toulouse
" " Yucatan

The above list has been allowed to stand as it was prior to the war, no attempt at a revision can be made at present. Last year we heard from Amsterdam, Bern, Giessen, Göttingen, Lausanne, Leipzig and Toulouse; this year we have heard from Breslau, Königsberg, Toulouse and Würzburg.

207 dissertations have been received and of these 187 were added to our collection during the year.

We have received in cash from the sale of duplicates, for the current year ending November 1, 1917: $403.70.

We have an exchange, arranged on a cash basis, with two New York dealers, and have received during the past year books and journals valued at $66.50 and have a balance to our credit of $10.51.

During the year we have distributed books and journals on exchange account to the following:

Boston Medical Library
Kansas City Medical Library Association
Medical Library Association, Exchange Bureau

And we have received exchanges from the

Columbia University Library
Kansas City Medical Library Association
Medical Library Association, Exchange Bureau
Smithsonian Institution
University of Michigan

With the aid received from exchanges and purchases made with funds appropriated for the purpose by the Library Committee, we have since November 1, 1916, completed the files of the following journals:

Archivio per le Scienze Mediche. Torino.
Revue d'Hygiène et de Police Sanitaire. Paris.
Zeitschrift für wissenschaft. Mikroskopie, Braunschweig.

Amount of fines collected from November 1, 1916, to November 1, 1917, $41.00.

The following is a list of rare medical books and works of special interest received during the past year:

INCUNABULA

(Total number of incunabula at this date, 218 Titles, 211 Volumes.)

Ars memorativa. Ingoldstadt, Johann Kachenlofen, Circa, 1493. The only copy known except one in the Berlin Royal Library. Fund for Rare Books.

Compendium sententiarum praeclarissimarum adversus astrologiam. Modena, Rocociola, Circa, 1490. [Hain-Copinger 5570.]

Glanvil, Bartholomaeus. Liber de proprietatibus rerum. Colonia, Koelhoff, 1481. [Hain-Copinger 2501.]

One of the earliest of the many editions of this famous encyclopædia of natural history and medicine. Fund for Rare Books.

Hermes Trismegistus. Liber de potestate et sapientia Dei. Venetiis, Damianus de Mediolano, 1483. [Hain 8461.]

Dedicated to Cosimo Medici by the commentator, Marsilius Ficinus Florentinus. Fund for Rare Books.

Lucretius Carus, Titus. De rerum naturæ liber. Verona, Paulus Fridenperger 1486. [Hain-Copinger 10282.]

The second issue of this work but the first dated edition. Only book from this press. Fund for Rare Books.

Molitor, Ulricus. De lamiis et phitonicis mulieribus. [Cologne, Cornelius de Zierikzee, Circa, 1490.]

Most famous XVth century book on witchcraft.
Fund for Rare Books.

de Orbellis, Nicolaus. Logica. . . cum textu Petri hyspani. Venetiis, Rubeus, 1500. [Not in Hain.]

Commentary on the writings of Petrus Hispanus who became medical Pope, John XXI. Fund for Rare Books.

[Pergamenus, Nicholas.] Liber dialogus creaturarum appellatus. Cologne, Conrad Winters de Homborch, 1481. [Hain 6126.]

Very rare edition of this famous collection of fables.
Fund for Rare Books.

Petrus de Abano. Expositio in librum problematum Aristotelis. Venetiis, Herbort, 1482. [Hain-Copinger 17.] Fund for Rare Books.

Pico della Mirandola, Giovanni count. [Opera.] Bononia, Benedictus Hectoris, 1496. [Hain-Copinger 12992.]

First edition, including his medical and astrological treatises.
Fund for Rare Books.

Publicius, Julius. Oratoriæ artis epitoma. . . insuper et perquam facilis memoriæ artis modus. . . Venetiis, Ratdolt, 1485.
[Hain 13546.]

Duke of Sussex's copy. Most beautiful book printed by Ratdolt.
Fund for Rare Books.

de Sacro Bosco, Joannes. Sphæra mundi. Venetiis, Bonetus Locatellus, 1490. [Hain 14113.]
Illustrated with astrological wood-cuts. Fund for Rare Books.

Salernum, School of. Regimen sanitatis Salernitanum. [Montpellier. 1480. [Hain 13747.]
First dated edition. [Brunet.] According to Ebert and Choulant, the first edition. Fund for Rare Books.

Salernum, School of. Regimen sanitatis Salernitanum. [Louvain, John of Westphalia, Circa, 1482.] [Hain 13749.]
Finely printed in two Gothic types at the second press in Louvain. Fund for Rare Books.

Salernum, School of. Regimen sanitatis Salernitanum. [Coloniæ, Circa, 1480.] [Hain 13751.]
Contains also Arnoldus de Villa Nova's own treatise on Hygiene. Fund for Rare Books.

Scott, Sir Michael. Liber phisionomiæ. . . de procreatione et hominis phisionomia. . . [Hain-Copinger 14550.] Venice, Jacopo de Fivizano, 1477.
First dated edition of the earliest printed work on generation. Fund for Rare Books.

Scott, Sir Michael. Liber phisionomiæ. . . de procreatione et hominis phisionomia. [Circa, 1490.] [Hain 14546.]
Fund for Rare Books.

Theobaldus. Bishop. Phisiologus de naturis duodecim animalium. Circa, 1480.] [Hain 15467.][
First edition. Rare. Fund for Rare Books.

Works of Special Interest

Academy of medicine of Philadelphia. Constitution. 1799.
Rare. Presented by B. Login & Son.

Account of the Philadelphia dispensary. Philadelphia, Budd, 1802.
Fund for Rare Books.

Acosta, C. Tractado de las drogas. Burgos, dé Victoria, 1578.
Very rare first edition, from the Library of the Marquis of San Francisco. Fund for Rare Books.

Bebelius, H. Commentaria epistolarum conficiendarum. Argentinæ, Schürer, 1513.

Interesting work, especially the nomenclature of diseases.

Fund for Rare Books.

Beddoes, T. and Watt, J. Considerations on the medicinal use. . . of factitious airs. 3 ed. London, Allen, 1779.

Fund for Rare Books.

Benedictus, A. Singulis corporum morbis. Venice, Junta, 1533.

First edition. Fund for Rare Books.

Blondus, M. A. De memoria libellus. Venetiis, de Nicolinis de Sabio, 1545. Fund for Rare Books.

Browne, J. Account of the wonderful cures performed by the cold baths, with advice to the water drinkers at Tunbridge. London, How, 1707. Fund for Rare Books.

Brunschweig, H. A most excellent and perfecte homish apothecarye. Trans. out the Almaine. Cologne, Birckman, 1561.

Fund for Rare Books.

Brunschweig, H. Noble experyence of the vertuous handywarke of surgery. London, Treveris, 1525.

First work on surgery in the English language. Exceedingly rare.

Fund for Rare Books.

du Choisel, Claude. Easy. . . method of treating persons bit by mad animals. London, Johnston, 1756.

Apothecary to the Jesuit Mission of Pondicherry, East Indies.

Fund for Rare Books.

Cogan, T. Haven of health. London, Bradwood, 1612.

First edition. Rare. This copy formerly belonged to George Steevens, editor of Shakespeare, and has his autograph.

Fund for Rare Books.

Columbus, M. R. De re anatomica libri xv. Paris, Foucher, 1562.

Fund for Rare Books.

Contardo, G. A. Il modo di preservarsi. . . dalla peste. Genova, Pavoni, 1630.

Very Rare. Fund for Rare Books.

Cornutus, J. Canadensium plantarum. Parisiis, le Moyne, 1635.

First edition. Rare. Fund for Rare Books.

Culpeper, N. Physicall directory. London, Cole, 1649.
Fund for Rare Books.

De balneis. Venetiis, Junta, 1553.
Scarce and interesting collection of works of 73 authors.
Fund for Rare Books.

Digby, Sir Kenelm. Choice collection of rare chymicall secrets. London, Hartman, 1682.
Rare work, illustrated with chemical instruments.
Fund for Rare Books.

Dodonæus, Rembertus. Niewe herball. Trans. out of French. London, Dewes, 1578.
Dedicated to Queen Elizabeth by the translator, Henry Lyte.
Fund for Rare Books.

Doolitel, T. Serious inquiry for a suitable return for continued life, in and after a time of great mortality, by a wasting plague, [anno 1665.] London, Johnson, 1666.
Very rare. On the great London plague.
Fund for Rare Books.

Eröffnetes philosophisches Vatterherz. Strasburg, Zetzner, 1650.
Early edition of rare work on alchemy. Fund for Rare Books.

Fage, J. Speculum ægrotorum. The sick-mens glasse. London, Lugger, 1638.
Curious treatise on popular hygiene and the doctrine of the four humors. Fund for Rare Books.

Fernelius Ambianus, J. Universa medicina. 6 ed. Hanover, Marnii, 1610. Fund for Rare Books.

Fludd, R. [Opera.] Francofurti, Kempfferi, 1621, 1623.
Presented by Henry K. Pancoast, M.D.

à Fonseca, Rodericus. De tuenda valetudine, et producenda vita liber. Florence, Sermartelli, 1602.
First edition. Fund for Rare Books.

Franchimond von Frankenfeld, N. Lithotomia medica. Prague, Zieger, 1683.
Very Rare. Fund for Rare Books.

Fürstenau, J. F. De spasmo vesico. Kintelii, Enaux, 1745.
Presented by Charles W. Burr, M.D.

Gerarde, J. Herball. London, Norton, 1597.
First edition. Fund for Rare Books.

Glauber, J. R. Consolatio navigantium. Amsterdam, Jansson, 1657.
First Latin edition. Fund for Rare Books.

Glauber, J. R. Opera chymica. Franckfurt a.M. Götzen, 1658–9.
Interesting work on alchemy. Fund for Rare Books.

Glauber, J. R. Tractatus de medicina universali. Amsterdam, Jansson, 1658.
Alchemy and the properties of gold. Fund for Rare Books.

Guerin, J. Le parfait chirurgien charitable. 7 ed. Lyon, Potin, 1666.
Contains a description of the plaster called "Manus Dei."
Fund for Rare Books.

Harvey, Gideon. De febribus tractatus theoreticus. London, Thackery, 1672.
First edition. Fund for Rare Books.

Hoffmann, F. Treatise of the extraordinary virtues of asses' milk. Trans. from the German. London, Whiston, 1754.
Rare. Fund for Rare Books.

Ingrassia, G. F. Informatione del pestifero. [Palermo, Mayda, 1576.]
Fund for Rare Books.

James VI, of Scotland; I of England. De abusu tobacci discursus. Rostock, Haller, 1644.
Extracts from James I's "Counterblast" in a Latin version.
Fund for Rare Books.

Journey of Dr. Robert Bongout, and his lady to Bath. London, Dodsley, 1778.
Burlesque-poem. Fund for Rare Books.

Letters to a sick friend. London, Parkhurst, 1682.
Presentation-copy to John Locke; contains his reputed autograph.
Fund for Rare Books.

Loselius, J. De podagra tractatus. 2 ed. Leyden, Maire, 1639.
By purchase.
Lovell, R. Enchiridion botanicum. 2 ed. Oxford, Davis, 1665.
Fund for Rare Books.

Lower, R. Traité du coeur. Paris, Michallet, 1679.
Fund for Rare Books.

M. M. M. Felix puerpera. Leyden, Vander Aa, 1684.
Rare first edition. Dedicated to Drelincourt.
Fund for Rare Books.

Maierus, Michael. De circulo physico quadrato; hoc est, auro, eiusque virtute medicinali. Jenæ, Gallari, 1616.
Very rare work on the medicinal properties of gold.
Fund for Rare Books.

Malfi, T. Il barbiere di Tiberio Malfi. Napoli, Beltrano, 1626.
First edition of very rare work on barber-surgeons by the "Counsel" of the Barber-Surgeons of Naples.
Presented by W. W. Keen, M.D.

Martinius, H. Anteambulo medicus. Bregæ, Tschorn, 1668.
Very rare first edition. Fund for Rare Books.

Matthioli, P. A. I discorsi. . . di Pedacio Discoridæ Anazarbeo. Vinegia, Valgrisi, 1555. Fund for Rare Books.

Meianus, Anselmus. Enchiridion naturale. Paris, Barier, 1509.
Rare interesting work. Fund for Rare Books.

Mesue Damascenus, J. Opera. 2 vols. Venetiis, Junta, 1589.
Two folio volumes in original vellum.
Fund for Rare Books.

Möllenbroccius, V. A. De varis, seu arthritide vaga scorbutica tractatus. Lipisæ, Grossii, 1663. Fund for Rare Books.

Montanus, J. B. In secundam fen primi canonis Avicennæ.
Venetiis, Valgrisii, 1557. Fund for Rare Books.

von Mynsicht, H. Thesaurus et armamentarium medico-Chymicum. Lugduni, Huguetan, 1649.
Celebrated work on hermetic philosophy.
Fund for Rare Books.

Naironus Banesius, A. F. De saluberrima potione cahve, seu cafe Romæ, Herculis, 1671.
Early tract on coffee. Fund for Rare Books.

Ochus, H. De pestilentibus. Brixiæ, Gromii, 1650.
First edition. Dedicated to the Duke of Mantua.
Fund for Rare Books.

Paëpp, J. Artificiosæ memoriæ. Lugduni, Vincentius, 1618.
Fund for Rare Books.

[Paëpp, J.] Jani phaosphori. . . mnemonicæ. Leyden, Vincentius, 1619.
Supposed to be Paepp's reply to the critics of his writings on mnemonics. Fund for Rare Books.

Paré, A. Works, Trans. out of Latin. London, Cotes, 1634.
More than 300 wood-cuts of surgical instruments and operations.
Fund for Rare Books.

Pechlin, J. N. De habitu et colore Aethiopum. Kiloni, Reumann, 1677.
Very rare. Fund for Rare Books.

de Peiruis des Ambies. Le medicin sincere. Marseilles, Brebion, 1675.
Fund for Rare Books.

Pena, P. et de L'Obel, M. Stirpium adversaria nova. London, Purfoot, 1571.
First book printed in England with engraving on copper adapted to cartography. The third to have copper-plate engravings.
Fund for Rare Books.

Petrarch, Franciscus. Vond er Aertzney bayder glück des guten und widerwertigen. Augsburg, Steyner, 1532.
Rare German translation of Petrarch's famous satires upon physicians. Fund for Rare Books.

Piana, G. B. Curiosissimi saggi. Torino, Zappata, 1695.
Fund for Rare Books.

Pipernus, P. De magicis affectibus lib. VI. [Naples, Montanari, 1635.]
Excessively rare work on diseases produced by enchantment.
Fund for Rare Books.

Plutarch. De. . . philosophorum naturalibus. Roma, Mazochius, 1510.
Very rare. Fund for Rare Books.

Putius, V. Expertus ac perutilis tractatus contra epidimiam. Perugia, de Cartulariis, 1523.
Interesting work on the plague, containing prescriptions, etc.
Fund for Rare Books.

Quercetanus, J. Practise of Chymicall and hermeticall physicke. London, Creede, 1605. Fund for Rare Books.

Rabiqueau, C. Le microscope moderne. Paris, Demonville, 1781.
Optician to the King. By purchase.

Rich store-house or treasury for the diseased. London, Purfoot, 1596.
First edition. Fund for Rare Books.

Riverius, L. Riverius reformatus. Editio nov. Geneva, de Tournes, 1696. Fund for Rare Books.

Royal college of physicians of London. Certain necessary directions. . . . for the cure of the plague. London, Barker, 1636.
Fund for Rare Books.

Royal hospital of King Charles II. Charter. Dublin, Faulkner, 1760.
Fund for Rare Books.

Ruellio, J. De natura stirpium. [Basel, Froben, 1537.]
First edition. Fund for Rare Books.

Ruland, M. Medicina pratica. Hanover, Antonius, 1610.
Curious collection of prescriptions. Fund for Rare Books.

Salernum, School of. Conservandæ bonæ valetudinis. Francofurti, Engenolph, 1568. Fund for Rare Books.

Salmon, W. Iatrica. London, Rolls, 1694.
Dedicated to King Charles II. Fund for Rare Books.

Sanders, Richard. Physiognomie, and chiromancie, 2 ed. London, Brook, 1671.
Very curious work on physiognomy and interpretation of dreams.
Fund for Rare Books.

Sanders, W. Observations on the superior efficacy of the red Peruvian bark. London, Johnson, 1782.
First edition. Fund for Rare Books.

[Saunier de Beaumont, J. abbé] Le grand miracle de nature metalique. Paris, Dehoury, 1660.
Rare tract on alchemy, edited by Castaigne.
Fund for Rare Books.

Screta, H. De febri castrensi maligna. Scafusii, Meister, 1686.
First edition, rare. Fund for Rare Books.

Simeon, Seth. Syntagma. . . . de alimentorum. Basileæ, Perna, 1561. Fund for Rare Books.

Temple, Sir William. bart. Miscellanea. 5 ed. London, Tonson, 1697.
Interesting essay on gout. Fund for Rare Books.

Tranzi, S. Trattato di peste. Roma, Gigliotto, 1587.
First edition, excessively rare. Fund for Rare Books.

True relation of the . . . cure of Mary Maillard. London, Baldwin, 1694.
Rare tract on a case of spontaneous reduction of congenital dislocation of the hip. Fund for Rare Books.

Turner, William. New herball. 2 Parts. First part printed at London, by Mierdman, 1551. Second part, Cologne, Birckman, 1562.
Very rare and valuable edition with numerous illustrations of plants. Fund for Rare Books.

Valdanius, Josephus. De mistione diaglogi duo. Basle, Perna, 1562.
First edition. Fund for Rare Books.

Valles Covarrubianus, F. Methodus medendi. Venetiis, Angelerius, 1589.
Physician to Philip II of Spain. Fund for Rare Books.

Vigilantius de Monte Cubiti. [Pseudonym.] Dreyfaches Hermetisches Kleeblat. Nürnberg, Endtern, 1667.
Edmund Dean's revision of "Mercurius Redivivus." Fund for Rare Books.

Wecker, H. J. Antidotarium speciale. Basilæ, Eusebius, 1588.
Very rare edition. Fund for Rare Books.

Wirsung, C. General practice of physicke. London, Adams, 1617. Fund for Rare Books.

Zapata, G. B. Li maravigliosi secreti di medicina. Venetia, Imberti, 1629. Fund for Rare Books.

Also eleven dissertations of the University of Leyden from the famous Plantin press, of the years 1593 to 1597.
Extremely rare. By purchase.

Manuscripts

Dorsey, John Syng. Day-books and ledgers; and manuscript notes on medical and surgical cases. 8 vols. [Phila.], 1798–1818.
Presented by Mrs. B. G. du Pont.

Fahnestock, Samuel. Collection of medicinal preparations. York Town, [Penna.], 1798. Presented by F. S. J. Stoddart.

Lister, Joseph. baron. Holograph letter, dated April 4, 1898, to W. W. Keen, M.D., on the subject of vivisection.
Presented by W. W. Keen, M.D.

Other Interesting Additions

Broadside. Bando, e provisione sopra gli abusi introdotti in Bologna, intorno alla professione della medicina, publicato in Bologna alli 23. di Decembre 1649. By purchase.

Broadside. Bando per sospetto di contagio, publicato in Bologna li 3. Giugno, 1656. By purchase.

Service sword of Horatio C. Wood during the rebellion of 1860.
Presented by H. C. Wood, M.D.

Sword taken from a wounded Confederate prisoner at hospital established immediately behind General Grant, when going through the Wilderness. Presented by H. C. Wood, M.D.

We have also received during the year a number of interesting and more or less valuable autograph letters.

November 1, 1916, a "Photostat," with the necessary equipment, was installed by the order of the Library Committee. The subject had received careful consideration and it was determined that this very ingenious and practically automatic photographic machine would be of the greatest service not only to the Fellows and others using the Library, but to the Library itself, in the

preservation of its incunabula and other rare and valuable books and manuscripts.

For the sake of economy (chemicals and the man's time), the Photostat has been used only two afternoons and evenings (Wednesday and Friday), of each week, summer months excepted. The charge for prints to the Fellows and to other than Fellows, is a nominal one, calculated to cover in a degree, the cost of paper, chemicals and time.

From the Fellows of the College there were 12 applications for prints:

Amount received	$29.65

From other than Fellows there were 10 applications for prints:

Amount received	35.20
Total	$64.85

This may possibly seem like a small showing; but it must be remembered that it is a new line of work and not generally known or its advantages appreciated. In every case the completed work has not only been satisfactory, but has called forth voluntary praise and words of appreciation.

For the Library 6102 prints have been made, large and small; this includes complete copies of 39 incunabula. The prints of a volume are paged, then sent to the binder where every two prints are pasted together to form a leaf, these leaves are mounted on guards and then the book is bound. A uniform style of binding, buckram with red labels, has been adopted. A number of these bound volumes have been on exhibition in the Reading-room during the past year and all who examined them expressed practically the same opinion that it was difficult to believe that they were photographic reproductions of printed books.

According to the instructions of the Library Committee these copies of incunabula and other rare books and manuscripts are

to take the place, upon the shelves, of the originals, and to be open for inspection and consultation. It is the understanding that when conditions are favorable, and the money available, proper accommodations will be built in, with the seventh tier of stacks, for the safe storage of the rare, and in some cases priceless, books and manuscripts belonging to the Library of the College.

Two imperfect books, one modern but out of print, were completed with photostat copies of the missing pages. When the large medical libraries realize the advantage of adding a photostat to their equipment, probably there will be arranged an exchange, or purchase of prints, by which many incomplete copies of valuable books can be completed.

It will be seen from the figures in this report that there has been a decrease in the visitors; books consulted and books taken out. A gradual decrease has been reported since the effects of the war in Europe became evident, say 1915; but with the entry of the United States in the war, April 6, 1917, the decrease in the use of the Library has been marked; this will be understood, however, when it is stated that nearly one-half of the Fellowship of the College is under Government Service and that a large proportion of the usual workers in the Library, not Fellows, have also volunteered their service.

The conditions covering the receipt of foreign medical literature have not improved, in fact have been more restricted than during the previous year; this has been felt particularly in the field of periodical publications, numbers are lost in transit and this loss is not known until the following number arrives. Claims are made for the missing numbers at once, but frequently without success. In many instances we are compelled to pay for the numbers which we claim. The end of this war will find in this Library, as in other libraries, many broken links that will have to be gathered together to form again the unbroken chain in their files of serial publications. The Library that can afford to send a special representative abroad to collect from its many sources the material issued in the various countries with which communication has been more or less interfered with, will have a great advantage.

In regard to books, there has been a slight increase in the number of new publications received for the year; namely, 30. All things considered this is a remarkably good showing. The following table shows the changes for the past three years.

	1917.	1916.	1915.
United States	456	425	283
Great Britain	121	161	100
France	144	15	8
Germany	20	90	175
Other countries	23	43	8
	764	734	574

The twenty volumes credited to Germany for this year are continuations; *i. e.*, books published in parts, and while the parts completing the volumes were received from our Agents in New York during the present year, the imprint in fourteen of them is 1915 and in the other six, 1916.

During the past year the Library Endowment Funds have been increased by an addition of $14,964.04 to the Morris Longstreth Fund.

Total amount of Library Endowment Funds at this date $320,425.92.

In the last Annual Report the Committee called the attention of the College to the condition of the books in the stacks from dust filtering through the closed windows and suggesting the advisability of having the windows sealed together with the installation of a proper ventilating system. Prompt action was taken by the College, and authorization was given to have made the necessary additions and alterations to the book-stacks as submitted in the Report, under the supervision of the Architect of the Building. Preliminary tests and examinations of various plans occupied considerable time and it was not until May 10, 1917, that the contracts were given—first—to seal all the windows in the stacks; for the sum of $1628; and—second—to install an air-washing

machine, heating radiators, fan, necessary ducts and piping, with thermostats, for a complete ventilating system; for the sum of $3930. The work of sealing the windows in the stacks was completed in August. The work of installing the ventilating system has been delayed by labor conditions and the uncertainty of transportation, and there are a few minor details still to be completed before the plant is ready for use. It should be stated that, in addition, a competent cleaner has been employed at a fixed salary, to work continuously and systematically in the stackroom.

Respectfully submitted,

FRANCIS X. DERCUM, M.D.,

Chairman.

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